# CRI Activity Report 2004-2007

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The Caesarea Edmond Benjamin de Rothschild Foundation Institute for Interdisciplinary Applications of Computer Science (CRI) was established at the University of Haifa in 2001 with an initial grant from the Caesarea Edmond Benjamin de Rothschild Foundation. CRI is an advanced research institute that specifically promotes research in interdisciplinary applications of computer science. While a number of computer institutes exist in Israel and abroad, CRI is one of the few specifically devoted to interdisciplinary research.

With the support of the Institute, many different disciplines are advanced through research, education and study programs. The common denominator of all programs undertaken with the support of CRI is that they are inherently interdisciplinary.

The Institute has three main tracks:

The Research Track promotes academic activities related to interdisciplinary research: conferences and workshops, an international visitors program, and varied projects of graduate students and post-doctoral students.

The Education Track initiates and assists in the formation of new programs between the computer science department and other departments, for university students and high school students. This track supports new courses and provides merit scholarships to outstanding students.

The Technology Track encourages advanced students and faculty members who wish to investigate and develop ideas and inventions that may have social or commercial value.

This report details the activity undertaken in each of these tracks over the period January 2004 – September 2007.
From the Director

Embracing Science and Technology Through Interdisciplinary Collaboration

The vision of the Caesarea Rothschild Institute has changed the University of Haifa. This is a bold statement - yet one based on landmark achievements in strengthening and accelerating the adoption of computer science and technology in various other fields. The young institute, which now hosts five laboratories producing groundbreaking research, has reached out to many researchers, and supports joint projects with over a dozen academic departments. During the four year period of this report, CRI has sponsored more than seventy gatherings, where leading researchers from widely different fields, and dozens of countries, have exchanged ideas and information, publishing their findings in numerous articles and books. The Institute now has formal scientific collaboration agreements with four different academic institutions abroad. CRI is also the mastermind behind the creation of more than fifteen new interdisciplinary courses at the University of Haifa.

Since the founding of CRI in 2001, through the generous support of the Caesarea Edmond Benjamin de Rothschild Foundation, and the University of Haifa, we have successfully and tenaciously pursued our founding mission: to advance research in interdisciplinary applications of computer science. Within the university, CRI has helped to enhance fields such as law, education, rehabilitation, linguistics, computational neural science, algorithm development, computer vision, psychology, statistics, biology, communications, information science, artificial intelligence and sociology. In this way, CRI has boosted the standing of the University of Haifa and of the greater academic community in Israel. CRI’s role has contributed to Israel’s ability to attract top researchers from around the world and to keep its own best minds at home.

CRI conferences and workshops have worked as a lever, pushing emerging fields forward at the University of Haifa. What distinguishes these meetings from others is the diversity of their participants, who come from many disciplines, creating lively research interactions, and bringing together many points of view. Our annual workshop on Interdisciplinary Applications of Graphs, Combinatorics and Algorithms has become a popular fixture on the Israeli academic scene. It has already generated the publication of the book “Graphs, Combinatorics and Algorithms” and a special issue of the journal “Discrete Applied Mathematics”. Experts in the field of Artificial Intelligence look to CRI for leadership in many areas. Together with researchers from Bar-Ilan University, we have co-sponsored symposia and research projects, and are now planning innovative new programs together. In the area of Law and Technology, our workshops and seminars have resulted in the creation of a unique book which bridges terrorism, technology and law enforcement; “Fighting Terror Online” will be published in 2008.

This year CRI renewed and expanded its scientific collaboration agreement with the Bruno Kessler Foundation (formerly ITC-irst), in Trento, Italy. The new funding of 600,000 euro will enable CRI to transform the intelligent museum guide project at the Hecht Museum from a trial venture into an integral part of the museum experience - a model to be adopted by museums around the world. Further scientific collaboration agreements were signed in 2006 with the Université Sorbonne (Paris IV), the University of Waterloo, Canada and the Florida Atlantic University; joint activities are already underway.

In education, our annual series on “Innovative Computer Applications: Inspiring Research and Development in Education” joins students of the Faculty of Education and the Department of Computer Science with leaders in the high-tech industry, exposing them to state-of-the-art developments in the field. Our annual “Seminar for Leading
High School Computer Science Teachers", together with "Machshava" at the Technion, provides an intensive three day encounter between Israeli high school teachers and computer science researchers, aiming to enrich the professional skills of the educators. This seminar has made a significant contribution to computer science education in Israel. The "Virtual Reality in Rehabilitation Workshop Series" brings together leaders in computer science and occupational therapy and rehabilitation. Held in collaboration with the University of Southern California, this workshop has had international recognition and has spawned new research projects at the University of Haifa. The CRI virtual reality laboratory, together with the Laboratory for Innovative Rehabilitation Technology, headed by Prof. Patrice L. (Tamar) Weiss, is successfully integrating artificial intelligence and virtual reality into rehabilitation. Its work has already yielded virtual environment tools now being used in rehabilitation clinics and hospitals in Israel.

In the near future, CRI will continue its projects in the above areas to ensure that the University of Haifa remains a leader in interdisciplinary applications of computer science. More than this, we look ahead to enriching the scope of the institute and the research it supports with new ideas and initiatives in the coming years.

I encourage all computer scientists, researchers involved in interdisciplinary applications, and potential sponsors to visit the Institute, participate in its activities and send us proposals for future cooperation and collaboration. It has been exciting for me, as a scientist and educator, to lead CRI through these important early years. I look forward to ensuring that CRI continues to successfully promote interdisciplinary applications of computer science, the University of Haifa, and research in Israel and beyond.

Martin Charles Golumbic
Director of the Institute
Professor of Computer Science
CRI Members and Staff

Director
Prof. Martin C. Golumbic

Scientific Manager
Dr. Irith Ben-Arroyo Hartman

Administrative Coordinator
Ms. Rona Perkis

Budget Coordinator
Ms. Avital Berkovich

Publications Editor & Trento Project Coordinator

System Administrator
Mr. George Karpatyan

Webmaster
Mr. Adi Rozen (2004-2006), Mr. Igor Gufeld (2006-2007)

University of Haifa, Department of Computer Science Faculty
Dr. Yosi Ben-Asher, Parallel Computation, Operating Systems, Compilers
Prof. Martin C. Golumbic, Graph Algorithms, Artificial Intelligence
Prof. Dan Gordon, Computer Graphics, Processor Arrays
Dr. Hagit Hel-Or, Computer Vision, Image Processing, Color Vision
Prof. Daniel Keren, Probabilistic Pattern Recognition, Computer Vision
Dr. Rachel Kolodny, Computational Biology, Algorithms
Prof. Gad M. Landau, Algorithms, Computational Biology, Pattern Matching
Dr. Larry Manevitz, Artificial Intelligence, Neural Networks
Prof. Ilan Newman, Algorithms, Complexity
Dr. Margarita Osadchy, Machine Learning, Computer Vision
Dr. Benny Pinkas, Cryptography, Computer Security, Computer Privacy
Dr. Yuri Rabinovich, Algorithms, Discrete Mathematics, Computational Complexity
Dr. Ronen Shaltiel, Computer Science Theory, Complexity, Random Numbers
Prof. Alek Vainshtein, Algorithms, Computational Complexity
Dr. Shuly Wintner, Computational Linguistics, Natural Language Processing

Left to Right: Dr. Irith Ben-Arroyo Hartman (Scientific Manager, CRI), Prof. Martin C. Golumbic (Director, CRI), Prof. Gad M. Landau (Department of Computer Science).
Other Affiliates

Dr. Dan Aharoni, School of Engineering, Kinneret College on the Sea of Galilee, member of the National Center for Computer Science Teachers

Dr. Michael Birnhack, Faculty of Law, University of Haifa

Dr. Jonathan Cohen, Department of Communication, University of Haifa

Dr. Ido Dagan, Department of Computer Science, Bar-Ilan University

Prof. Niva Elkin-Koren, Faculty of Law, University of Haifa

Dr. Uri Feintuch, School of Occupational Therapy, Hadassah-Hebrew University

Prof. Gregory Gutin, Department of Computer Science, Royal Holloway, University of London, England

Prof. Robert E. Jamison, Mathematical Sciences, Clemson University, Clemson, SC

Dr. Tsvi Kuflik, Department of Management Information Systems, University of Haifa

Ms. Tami Lapidot, Machshava - the Israeli National Center for Computer Science Teachers, Technion - Israel Institute of Technology, Haifa

Prof. Shalom Lappin, Department of Philosophy, King's College, London

Prof. Moshe Lewenstein, Department of Computer Science, Bar-Ilan University

Dr. Marina Lipshteyn, Coesarea Rothschild Institute, University of Haifa and Ethos Networks

Prof. Uri Peled, Department of Mathematics, Statistics and Computer Science, University of Illinois at Chicago

Dr. Daphne Raban, Graduate School of Management, University of Haifa

Prof. Sheizaf Rafaeli, Graduate School of Management, University of Haifa

Dr. Michal Stern, Department of Computer Science, Academic College of Tel Aviv-Jaffa

Prof. Oliviero Stock, ITC-irst, Trento, Italy

Prof. Moshe Vardi, Department of Computer Science, Rice University

Prof. Patrice L. (Tamar) Weiss, Department of Occupational Therapy, Faculty of Social Welfare and Health Studies, University of Haifa

Prof. Michal Yerushalmy, Faculty of Education, University of Haifa

Advisory Board

Prof. Alexander-Zeev Guiora, Department of Psychology, University of Haifa

Prof. Naomi Josman, Department of Occupational Therapy, Faculty of Social Welfare and Health Studies, University of Haifa

Prof. Gad M. Landau, Department of Computer Science, University of Haifa, (Acting Dir. of CRI, 2005/6)

Dr. Larry Manevitz, Department of Computer Science, University of Haifa

Prof. Gadi Moran, Department of Mathematics, University of Haifa

Prof. Ilan Newman, Department of Computer Science, University of Haifa

Scientific Advisory Board for the Trento-Haifa Project

Prof. Barbara Grosz, Division of Engineering and Applied Sciences, Harvard University

Prof. Andrew Ortony, School of Education and Social Policy, Northwestern University

Prof. Wolfgang Wahlster, German Research Center for Artificial Intelligence, Saarbrücken, Germany
Promoting Research and Technology

The Caesarea Rothschild Institute promotes interdisciplinary research in many ways. It holds conferences; conducts seminars, workshops and new interdisciplinary courses; sponsors specialized research laboratories and supports research projects.

We list below the research laboratories at CRI:

Research Laboratories

Computational Linguistics Laboratory

The Computational Linguistics Laboratory is involved in research and teaching in diverse areas of computational linguistics and natural language processing. Of primary interest are investigations related to Hebrew, as well as to other Semitic languages, notably Arabic.

The laboratory is headed by Dr. Shuly Wintner and includes: Post-doctoral researchers, Nurit Melnik and Yuval Krymolowski; Ph.D. student: Yael Sygal; and M.Sc. students: Ezra Daya, Daniel Feinstein, Amit Kirschbaum, Danny Shacham and Shlomo Yona.

The following is a list of the laboratory’s projects supported by CRI in the period 2004-2007:

Hebrew to English Machine Translation

Researchers in Haifa: Yuval Krymolowski and Shuly Wintner. This project is a joint collaboration with a team at the Language Technologies institute, Carnegie Mellon University, headed by Alon Lavie.

This project developed a preliminary Hebrew-to-English Machine Translation (MT) system under a transfer-based framework specifically designed for rapid MT prototyping for languages with limited linguistic resources. The task is particularly challenging due to two main reasons: the high lexical and morphological ambiguity of Hebrew and the dearth of available resources for the language. It uses existing, publicly available resources and adapts them in novel ways to support the MT task. The methodology behind the system will be based on two separate modules: a transfer engine which produces a lattice of possible translation segments, and a decoder which searches and selects the most likely translation according to an English language model. This project uses a set of manually crafted transfer rules to improve the translations. Performance is evaluated using state-of-the-art measures.
Hebrew Morphological Disambiguation
Researchers: Danny Shacham and Shuly Wintner

Morphological analysis is a crucial stage in a variety of natural language processing applications. When languages with complex morphology are concerned, even shallow applications such as search engines, information retrieval or question answering, let alone heavier applications such as machine translation, require morphological analysis and disambiguation as a first step. The lack of a morphological disambiguation module for languages such as Hebrew or Arabic handicaps the performance of many other applications. The goal of this project is to develop a morphological disambiguation module which could be used to rank the analyses produced by a state-of-the-art morphological analyzer.

Computational Grammar of Inverted Constructions in Modern Hebrew
Researcher: Nurit Melnik

Verb-initial constructions are those in which the verb appears in a clause-initial position and is followed by the subject. Under the assumption that the default word order in Modern Hebrew is subject-verb-object, this type of a construction is considered inverted. A formal analysis of verb-initial constructions in the framework of Head-Driven Phrase Structure Grammar (HPSG) is presented. An important feature of HPSG, which distinguishes it from competing frameworks, such as Chomsky’s Government and Binding theory and its variants, is its underlying mathematical formalism. As such, grammatical theories in HPSG can be implemented and consequently tested against “real” data. The main objective of this project is to develop a computational implementation of the grammar and to test it against “real” corpus data.

WordNet for Hebrew
Researchers in Haifa: Danny Shacham, Noam Ordan, Iris Eyal and Shuly Wintner (and, previously, Margalit Zabludowski). This project is jointly conducted with a team at the TCC Division ITC-irst, Trento, Italy.

WordNet is an online lexical reference system whose design is inspired by current psycholinguistic theories of human lexical memory. English nouns, verbs, adjectives and adverbs are organized into synonym sets, each representing one underlying lexical concept. Different relations link the synonym sets. Following the success of the English WordNet project, similar networks have been developed for a variety of languages. In particular, researchers at ITC-irst in Trento, Italy have developed a methodology for parallel development of multilingual WordNets. The system, called MultiWordNet, contains information on several aspects of multilingual dictionaries, including lexical relationships between words, semantic relations over lexical concepts and several mappings of lexical concepts in different languages.

Our goal in this project is to use the MultiWordNet methodology in order to construct a Hebrew WordNet, similar to the one developed at ITC-irst (and, therefore, will work in English, Italian and Spanish).

See page 42 for the list of publications related to the Computational Linguistics Laboratory

Screen capture of the Wordnet program
Stringology Laboratory

The Stringology Laboratory deals with research and teaching problems related to sequences with applications in different fields of science such as computational biology, image processing and information retrieval.

The laboratory is headed by Prof. Gad M. Landau and includes: Dr. Tzvika Hartman, Prof. Moshe Lewenstein and Dr. Dekel Tsur; Ph.D. students: Danny Hermelin and Oren Weimann; M.Sc. students: Shiri Dori, Nadav Efraty, Lilia Greenenko, Carmel Kent, Shahar Keret, Liat Leventhal and Nitson Oz.

Current research interests and past projects of the group include:

- Haplotype inference problems: finding haplotypes that explain given genotypes using different models
- Indexing and dictionary problems in Haplotype inferring
- Improvement of known RNA alignment algorithms and the design of new algorithms for various scenarios (e.g. local alignment)
- Enhancing dynamic programming techniques in sequence alignment via contemporary methods
- Data-structure design and analysis
- The design of parameterized and approximation algorithms for NP-hard string problems occurring in computational biology

A graphic from "Common Structured Patterns in Linear Graphs: Approximations and Combinatorics" by Guillaume Fertin, Danny Hermelin (Department of Computer Science, University of Haifa) and Romeo Rizzi

See page 45 for the list of publications related to the Stringology Laboratory.
Graph Algorithms and Theory Laboratory

This laboratory carries out research in the areas of graph theory, algorithms and theory of computation. Graph theory is a sub-field of combinatorics, a relatively new discipline, developed extensively within the past fifty years, which deals with finite structures and the relationship between their elements. Graph theory serves as a theoretical basis for computer science.

Theoretical computer science involves research on the complexity of algorithms and various models of computation. This includes the design of efficient algorithms, parallel models, combinatorial optimization and randomized algorithms. Two weekly seminar series which meet throughout the academic year are sponsored by the laboratory.

The laboratory is headed by Prof. Martin C. Golumbic and includes: Dr. Andrei Asinowski, Dr. Irith Ben-Aroyo Hartman, Dr. Eli Berger, Dr. Marina Lipshteyn, Prof. Ilan Newman, Dr. Yuri Rabinovich, Dr. Udi Rotics, Dr. Michal Stern and Prof. Alek Vainshtein; Graduate Students: Elad Cohen, Shimon Shrem and Guy Wolfovitz.

Since its inception in 2001, CRI has become a leading national forum in the field of graph theory, combinatorics and algorithms. Every year, the laboratory organizes the “Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics and Algorithms.” This conference attracts top researchers from Israel and around the world. It has resulted in the publication of books and special issues of professional journals. The keynote speakers since 2001 have been: Richard Karp (University of California, Berkeley), Robert Tarjan (Princeton University), Peter Hammer (Rutgers, The State University of New Jersey), Andrew Yao (Princeton University), Michael Rabin (Harvard University and Hebrew University), Michel Goemans (Massachusetts Institute of Technology), Adi Shamir (Weizmann Institute of Science) and Stephen Smale (University of Chicago).

Current research activities of the laboratory include:

- Combinatorial mathematics of path partitions in directed graphs
- Algorithms and applications of structured families of intersection graphs
- Tolerance graph problems
- Boolean functions
- Combinatorial property testing and randomized algorithms
- Computational aspects of metric spaces

See page 48 for the list of publications related to the Graph Theory Laboratory.
Neurocomputation Laboratory

The field of neurocomputation is concerned with the possibility of computation in computers by following the paradigm and analysis of computation that occurs in neurons and the brain. In recent years this has resulted in breakthroughs in pattern recognition, learning theory, clustering, associative memory and fault tolerant computation. Consequently, the precision resulting from the computational and mathematical viewpoint has led to insights helping to clarify one of the ultimate human research endeavors: understanding the way the human brain works.

The Neurocomputation Laboratory is directed by Dr. Larry M. Manevitz and includes: Dr. Orna Peleg and Dr. Malik Yousef; Ph.D. student: Hananel Hazan; M.Sc. students: Omer Boehm, Ariel Gorfinkel, Aviad Itzkovitch, Maya Maimon, Eugene Mednikov, Ronen Shpiegel, Ran Timor and Carmit Tsadok.

The following is a list of research projects undertaken in the period 2004-2007:

Reading the Mind: Using Machine Learning to Identify Cognitive Tasks from Physiological (MRI) Data
Researchers: David Hardoon, Larry Manevitz, Rafael Malekh and Omer Boehm

The goal of this project is to link raw physiological MRI data to cognitive tasks. The researchers attempt to recognize which cognitive task is being performed by examining MRI data. In one experiment while the subject looked at a picture an MRI was performed. The researchers employed machine learning techniques as the recognizing methodology. By only examining the MRI results, they were able to determine, with very high probability, which picture a subject was looking at. In addition to visual tasks, the researchers also conducted experiments where they attempted to determine which motor tasks were being performed.

Modeling a Patient in a Virtual Reality Environment for Use in Diagnostics
Researchers: Uri Feintuch, Eugene Mednikov, Larry Manevitz and Ronen Spiegel. This is a collaborative project with the Laboratory for Innovations in Rehabilitation Technology (LIRT).

This project utilizes artificial neural networks to automatically develop a model of a patient using data obtained from the user’s activities in the Virtual Reality Environment. This is technically challenging because of the noise in the data source. Once developed, this patient-specific model can then be used for differential diagnosis, for prognosis, as well as for testing the effectiveness of different variations in rehabilitation schemes.
**One Class Identification of Micro-RNA**
Researchers: Malik Yousef and Larry Manevitz

The recent discovery of the importance of microRNA has led to problems in identifying these structures in physiology. This research uses one-class machine learning tools developed in earlier work in our laboratory for identifying these structures.

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**A Large-scale Model of the Cortex Using Information Theoretic Measures and a Discrete Integrate and Fire Neuron**
Researchers: Larry Manevitz, Maya Maimon, Paul Gabbott and Carmit Tzadok

One approach to understanding how the human cortex computes is to explore how the individual neurons compute and how they are put together to form emergent computation. However, since the numbers are so large, there are theories of its computation which can only be tested in very large models. One approach is to use in vivo or ex vivo models but this is subject to the difficulty of control. A complementary approach is to use computational models. However, large models present significant computational resource difficulties. This is true for constructing and running such models, and also for analyzing and understanding their outputs.

In this project we build large scalable models which can compute with millions of neurons. The basic unit of these models is a discretized version of the integrate and fire neurons (the discretization is the key to avoiding numerical analysis problems). We also implement information theory based tools to understand the results. One of the results explains why specific physiological structures in the brain lead to more reliable computations.

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**Simulating a Psychological Model of Interactions Between Right and Left Cortical Hemispheres during Reading**
Researchers: Hananel Hazen, Orna Peleg, Zohar Eviatar and Larry Manevitz

This research shows that unlike theories in the cognitive science literature, some simple assumptions about the connections between types of information in the right and left hemisphere of the brain can explain experimental results on reading ambiguous words. For example, we show that the postulated differences between the right and left hemispheres explain isolated visual field experiments and explain how one hemisphere can recover from a misleading solution to the ambiguity.

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**Using Associative Memory Systems for Efficient Collaborative Filtering**
Researchers: Shlomo Berkovsky, Yaniv Eytani and Larry Manevitz

Collaborative filtering is a methodology of giving recommendations to users (e.g. for movies, books, etc.) based on a model of the user and a very large database of partial evaluations. A central difficulty in this is that, typically, the individual recommendations are sparse and one must find how to combine them to give the user a recommendation. In this project, the ideas of associative memory systems are employed to design an efficient way to access and use this information.
Genetic Mappings, Synchronized Optimization and Linked TSP Problems

Researchers: Victoria Pincus, A. Korol, D. Mester and Larry Manevitz

This research, in collaboration with the Institute of Evolution at the University of Haifa, shows how to build a consensus map combining different partial map genetic markers (perhaps coming from different laboratories). The central idea is to use an optimization problem based on considering several linked travelling salesman problems.

See page 51 for the list of publications related to the Neurocomputation Laboratory.
The laboratory is headed by Prof. Patrice L. (Tamar) Weiss and includes: Prof. Naomi Josman, Dr. Rachel Kizony, Dr. Yochy Laufer, Dr. Debbie Rand and Dr. Sara Rosenblum; Post-doctoral fellows: Dr. Assaf Dvork, Dr. Eynat Gal and Dr. Uri Feintuch; Ph.D. students: Orit Elion, Sigal Jakoby, Liat Raz and Carmit Shpigelman; M.Sc. students: Soraya Basha, Gili Dotan, Neta Erez, Galia Gutwelig, Jaquline Haj, Ayelet Reisberg and Smadar Sasser.

The following is a list of projects of the laboratory for the period 2004-2007:

**Integrating Haptic-Tactile Feedback into a Virtual Environment for Rehabilitation**

Using Gesture Tek’s video capture system, Gesture Extreme, the researchers integrated the system with haptic feedback provided by vibratory discs attached to the users’ hands. A usability study was performed, suggesting that an intervention tool of greater power and flexibility is produced. The system appears to be feasible for testing the relevance and contribution of the different feedback modes: (1) visual (2) visual-aural, (3) visual-haptic and (4) visual-haptic-aural.

**Virtual Reality in the Treatment of Victims of Terrorist Bombing with Post-Traumatic Stress Disorder**
Researchers: Naomi Josman, Azucena Garcia-Placios, Ayelet Reisberg, Eli Somer, Patrice L. (Tamar) Weiss and Hunter Hoffman

Since the beginning of the Palestinian “Intifada” (the uprising in September 2000), approximately 1,000 Israelis and 2,500 Palestinians have been killed. Approximately 7,000 Israeli civilians have been treated for physical trauma resulting from deadly terrorist suicide bombing attacks directed at Israelis. It is estimated that a substantially larger number of people have developed post-traumatic stress disorder (PTSD). A number of carefully
controlled studies have documented the effectiveness of Prolonged Exposure for the treatment of PTSD. Virtual reality (VR) exposure therapy is based on a similar paradigm, but rather than self-generating imagery, patients wear a VR helmet and enter a three-dimensional (3-D) computer generated virtual world to help them recall their memory of the traumatic event.

In this project, a new VR therapy software called “BusWorld” was developed for treating PTSD in civilian survivors of Israeli terrorist bus bombing attacks. The therapist controls what the patient sees in the virtual simulation via predefined function keys. The patient is gradually exposed to more severe renditions of the simulation, evoking higher degrees of anxiety. The therapist shows the patients how to cope with their anxiety and helps them adopt a more functional response to the traumatic event (e.g. decreased feelings of guilt).

Haptic-Aural Virtual Environments for Way-Finding by Children with Congenital Blindness: Feasibility Study

Researchers: Uri Feintuch, Jaqueline Haj and Patrice L. (Tamar) Weiss

People who are blind find that navigating in new environments constitutes a major hurdle in their road to independence. This study proposes a system which may aid them in overcoming this obstacle. The HaptiGuide is an affordable system which employs a standard desktop computer and a commercially available off-the-shelf haptic joystick. The HaptiGuide enables the construction of simple two-dimensional haptic-aural virtual environments. Navigating by the haptic joystick, the user may virtually explore a new environment prior to encountering it in the physical world.

This study describes a feasibility study, where nine children who are congenitally blind, were introduced to a new environment via the HaptiGuide. After traversing the virtual environment, the participants were asked to perform various wayfinding tasks in the equivalent physical environment. The results indicate that the participants generalized the knowledge acquired during the virtual exploration and successfully applied it to the physical environment.

Assessment of Mechanical Neck Disorders in a Virtual Environment

Researchers: Yocheved Laufer, Patrice L. (Tamar) Weiss and Hilla Sarig-Bahat

Mechanical Neck Disorders (MND) such as Whiplash Associated Disorders (WAD) constitute a major cause of disability in the western world, with significant ramifications for the injured individual and for society at large. The purpose of this project is to develop an innovative and objective assessment tool for individuals suffering from MND. The study will involve computer programming of an appropriate virtual reality (VR) environment in which subjects will be encouraged to interact actively in a game scenario, which will facilitate head movements without directly asking for them. Following the VR “game,” data regarding the patient’s performance will be extracted from the VR system and analyzed to provide outcome measures relating to the subject’s active neck function. Measurements from asymptomatic subjects will be compared with those of patients suffering from neck pain. This will help to reveal the sensory-motor deficiencies of patients with neck pain, in an objective manner, independently of their report or subjective complaints.
Tele-evaluation of Handwriting Difficulties

Researchers: Sara Rosenblum, Patrice L. [Tamar] Weiss and Dan Chevion

Disturbances in handwriting legibility and speed (known as dysgraphia) are problematic for about 10-30% of elementary-school-aged children. Many adults who suffer from neuromuscular pathologies of different types (e.g., Parkinson's disease, multiple sclerosis and Alzheimer's disease) also experience progressive deterioration of the quality of their handwriting. The aim of the project is to develop a set of analytic tools for computerized, remote evaluation of handwriting samples from dysgraphic children and adults. The software will be modular such that data collection will take place in various clinical and educational settings throughout Israel and around the world (Hebrew, English, Chinese and Thai handwriting). These data samples will then be transferred to the laboratory for subsequent analysis and interpretation. Recommendations for handwriting intervention will be returned to clinicians and educators.

A Sample of Digitized Handwriting: The green line shows the in-air trajectories of the pen during writing.

See page 54 for the list of publications related to this laboratory.

Other CRI Projects

Quantitative Description of Learning-Induced Modifications in Firing Patterns of Olfactory Cortex Neurons

June 2003 – June 2004

Researchers: Daniel Keren [Department of Computer Science] and Edi Barkai [Center for Brain and Behavior]

The aim of this project is to find a method for identifying the firing characteristics in the frequency domain. A combination of ideas from frequency analysis and pattern recognition is proposed in order to isolate the most dominant changes in the firing pattern after a process of training. One approach is to look at the problem in the context of machine learning, given two populations: A (after training) and B (before training). The differences are then observed. This yields information on what changed during the training process.
Decision Making in the Software Life Cycle Using Microeconomic Models
June 2003 – October 2006

Researchers: Dan Peled (Department of Economics), Eitan Farchi (IBM Haifa Research Lab), Peleg Yiftachel, Yuval Rapaport-Rom (Department of Computer Science) and Irith Hadar (Department of Management Information Systems)

This project suggests a novel approach for experimentally evaluating the resource allocation process in software development and its impact on the resulting quality. The proposed methodology, based on microeconomic theory of the firm and software engineering, designs a model of software production function and estimates it using experimental data. This study will record, in a controlled experimental environment, how software developers combine various software production phases in an attempt to create the most profitable product.

Enhancing Elementary School Math Teachers' Internet Skills for the Benefit of Their Professional Development
September 2003 – April 2004

Researcher: Michal Sukenik (Faculty of Education)

This project is aimed at enhancing the professional development of mathematics teachers in elementary schools by exposing them to the richness of Internet sites in general and the National Center’s site in particular. Teachers from ten elementary schools in the Haifa region participate in workshops in which they acquire Internet skills. Each teacher then receives, for a period of three months, personal guidance and support tailored to his/her needs and knowledge. This training program has a strong impact on the teachers’ ability to integrate technology into instruction and to incorporate technological tools and resources into lesson plans in order to enhance student learning.

Strategies for Searching Graphs
October 2003 – October 2004

Researcher: Shmuel Gal (Department of Statistics)

This project studies the search game in a graph with an arbitrary starting point for the searcher. In particular, strategies for non-symmetric stars and for trees are of interest. Attempts are made to characterize the family of graphs for which the optimal search strategy guarantees that the expected search time does not exceed half the minimal length of a path which covers all the edges in the graph. A possible extension would be to achieve results for several searchers who search in parallel.

Using Unspecified Ontologies for E-Commerce Applications in P2P Mode
October 2003 – October 2004

Researchers: Yosi Ben-Asher and Shlomo Berkovsky (Department of Computer Science)

The project aims to develop and to implement a novel concept of semantic routing to efficiently create, search and manage dynamic forms in peer to peer (P2P) systems. A novel technique of unspecified ontologies is used,
allowing any user to compute a “semantic” routing path to any requested form without knowing its IP address. The implemented system is tested on a restricted domain and then published in order to create a market of general goods based on the semantic routing. This will elevate e-commerce applications to the realm of P2P systems and make e-commerce activities accessible to a relatively larger community of users.

**Odd Hole Free Graphs**

October 2003 – June 2006

Researchers: Shimon Shrem, Martin C. Golumbic (CRI) and Michal Stern (CRI)

This research presents two algorithms to detect a smallest odd hole in two graph classes, triangle-free graphs and claw-free graphs. The algorithm for triangle-free graphs is based on a simple BFS algorithm; the second algorithm, for claw-free graphs is based on a modified BFS, which is called Γ-BFS. The first algorithm is rather straightforward but it describes and illustrates the approach for detecting an odd hole in a very simple manner. For a graph G on n vertices and m edges, the time complexity for the first algorithm is $O(nm)$ and the second is $O(nm^2)$. Both are very easy to implement. We suggest an extension of our approach and propose an algorithm for detecting an odd hole in a general graph.

**A Study of Human Stereoscopic Eye-Movements to Provide Data for Stereo Computer Vision Models**

March 2004 – March 2005

Researchers: Joel Norman and Pe’erly Setter (Institute of Information Processing and Decision Making)

This project aims to study human stereoscopic vision in order to provide computer vision experts with data that will help improve the development of more efficient computer stereo vision. The study utilizes state-of-the-art eye-tracking methodology in order to shed light on the mechanisms underlying the stereoscopic proficiency of humans. We focus on convergence eye-movements, the changes in the angle between the two eyes. These movements yield information about the changes in the depth of the point on which the two eyes are fixating and shed light on how the human visual system solves the correspondence problem.

**Unraveling the Genetic Basis of Facial Expression of Human Emotions**

March 2004 – March 2005

Researchers: Gili Peleg, Gadi Katzir, Eviatar Nevo (Institute of Evolution), Michal Kamara, Leonid Brodsky, Ofer Peleg, Hagit Hel-Or and Daniel Keren (Department of Computer Science)

This project seeks to determine the genetic basis of the facial expressions of human emotions. The facial expressions of 21 congenitally blind (blind since birth) individuals are compared with the expressions of 30 of their relatives. The facial expressions of congenitally blind people could not have been influenced by their environment and therefore similarities between the expressions of the blind individuals and their family members may be attributable to genetics. The results of this research have been reported in the Proceedings of the National Academy of Science, Forbes, The Guardian, Nature, Scientific American and by the BBC.
Novel Approach for Finding Concurrent Bugs
October 2004 – October 2005

Researchers: Yosi Ben-Asher, Yaniv Eytani (Department of Computer Science) and Eitan Farchi (IBM Haifa Research Lab)

This project is related to the problem of finding bugs in programs that run concurrently. The aim of the project is to model concurrent events as “good,” “natural” or “bad” according to the effect conditional seeding at concurrent event has on finding a concurrent bug. Intuitively, conditional seeding of good concurrent events is needed in order to uncover the concurrent bug, while conditional seeding of bad concurrent events may hide the bug. The model is used to improve the bug finding capabilities of raceFinder, a previously developed tool for finding concurrent bugs.

Non-Stationary Hidden Semi Markov Models in Activity Recognition
October 2004 – June 2007

Researchers: Einat Marhasev, Meirav Hadad, Martin C. Golumbic (CRI) and Gal A. Kaminka (Bar-Ilan University)

We investigate the use of Hidden Semi-Markov Models (HSMMs) in recognition of activities with varying durations. We present an augmentation of HSMMs, called Non-Stationary Hidden Semi Markov Models (NHSMMs) and its application in activity recognition. We compare the performance of HMMs, HSMMs and NHSMMs in recognizing normal and abnormal behavior, revealing the advantages of each method under different conditions. For this, we use synthetic data from a simulator of airport passenger movements and real world data from users in a computerized maze task. We show that for relatively simple activity recognition tasks, both HSMMs and NHSMMs easily and significantly outperform HMMs. In some tasks the NHSMMs outperform the HSMMs and allow significantly more accurate recognition. The results show that HSMM and NHSMM successfully differentiate between human subject behaviors. This leads to a novel application of activity recognition methods in clinical diagnosis. These results suggest that semi-Markov models may be useful in clinical settings for the evaluation and assessment of patients suffering from various cognitive and mental deficits.

Recommendation and Negotiation System Integration
October 2004 – June 2007

Researchers: Pavel Bekkerman, Meirav Hadad, Martin C. Golumbic (CRI), Sarit Kraus (Bar-Ilan University) and F. Ricci (ITC-irst, Italy)

This research involves recommendation-and-negotiation system integration and their application in a multi-agent e-commerce environment for efficient customer-customer interactions. A new group recommendation system was implemented and studied. The group recommender relies on a process in which automated negotiation agents, acting on behalf of human group members, participate in a direct or mediated cooperative negotiation. Based on individual recommendations the system generates group recommendations. Our goal is to demonstrate the benefits of systems integration in the research and development of new intelligent systems for e-commerce.
Merging Programs to Increase Inside CPU Parallelism
November 2004 – November 2005

Researchers: Yosi Ben-Asher and Moshe Yuda (Department of Computer Science)

Source level merging is a transformation that merges two independent programs into a single program by mixing code statements from the two programs. The resulting program should be faster than two separate programs and should be easier to debug. Merging programs/threads at the source level should improve: the size of the basic blocks, the scheduling time and the register pressure during compilation. It should also save branch instructions (e.g., by merging loops and if statements). Such merging is clearly beneficial for conventional CPUs, when executing multi-threaded code. It is especially useful for simultaneous multithreading (SMT) CPUs which draw their performance from successful inner scheduling of threads.

The Role of Phonology in Silent Reading: Converging Evidence from Computational Modeling and Eye-Movement Experiments
December 2004 – December 2005

Researchers: Orna Peleg (Institute of Information Processing and Decision Making), Zohar Eviatar (Institute of Information Processing and Decision Making) and Larry Manevitz (Department of Computer Science)

There are two major interrelated goals of this research project. The first and most general goal is to explore the processes involved in reading. Specifically, examining the role of phonology in accessing word meaning. This theoretical goal is pursued using two converging methodologies: tracking the eye-movements of readers and computational modeling. Computational models provide not only a replication of empirical findings but important insights as to why such findings arise. Such models are subject to modification which cannot be easily done in human-based studies. The second goal is to look at these phenomena in the context of reading Hebrew. Given that the vast majority of both cognitive and computational models of reading are based on Indo-European languages utilizing Latin scripts, it is important to test the generality of these models, in addition to investigating specific processes related to the reading of Hebrew.

Data Entanglement for Censorship Resistance
April 2005 – April 2006

Researcher: Benny Pinkas (Department of Computer Science)

We investigate the use of data entanglement for fighting censorship. Publishing systems based on data entanglement mix together the documents which they store, such that each block of every document is necessary for the retrieval of other documents. The removal or change of a single document therefore causes irreversible damage to many other documents and prevents their retrieval. This design raises the cost of censorship by ensuring that censoring a single document causes damage to many other documents. An additional deterrence against censorship in this type of system is that any change to a single document is visible by many parties, even those who are not interested in that document. The project objectives are two-fold: investigating better models of censorship resistant systems and improving the constructions of such systems.
Applying Clustering Analysis and Ontological Methods for Developmental Disorder Diagnosis

Researchers: Mor Peleg (Department of Management Information Systems), Tsvi Kuflik (Department of Management Information Systems), Nuaman Asbeh (Department of Statistics) and Mitchell Schertz (Institute for Child Development, Kupat Holim Meuhedet, Herzeliah)

In this research, we develop a developmental disorder ontology that is satisfactory to practitioners in the field that will ensure that all practitioners who diagnose disorders in children are using the same agreed-upon terminology and interpreting the terms in a consistent way. Furthermore, we apply clustering methods aided by an ontology of diagnostic patterns (patient data, including disorder diagnosis) that will point out the shared findings within diagnostic patterns in each cluster group. By analyzing the clusters, we deduce mechanisms that explain the manifestation of co-morbid diagnoses and set the stage for studies on the etiology of developmental disorders, using groups of children who are more homogenous in their particular developmental disorders.

Simulation and Forecasting of the Evolution of Cooperation in Non-Repeated Human Interactions
October 2005 – October 2006

Researcher: Ilan Fischer (Department of Psychology)

The goal of the project is to develop an evolutionary computerized model that will describe and forecast outbreaks of cooperative and hostile behaviors, based on the distribution of the cognitive characteristics of the examined populations. The objectives of the study are: to develop a genetic algorithm that will process empirical data and produce meaningful predictions of outbursts of aggressive behaviors among large populations, to develop a repeated game version of the proposed solution and to integrate that solution into simulation software that will enable testing its performance in a range of ecological niches comprised of various strategies (such as Tit For Tat, Win-Stay, or Lose-Shift).

Document-Query Unification as a Coordination Game
February 2007 – October 2007

Researcher: David Bodoff (Graduate School of Management)

In this research, we propose to view the document-query unification problem from a behavioral point of view. Instead of asking what an algorithm should do, we ask how populations of searchers and content-providers actually behave in this situation. Suppose there is a group of searchers and a group of relevant document authors/indexers. In order to maximize the accessibility of documents they would like to match each other, but the two sides begin with different terminologies. Will experience lead to the emergence of a standard terminology? What factors influence this? Which side’s terminology will be adopted? What factors influence this? This research, which is about the emergence of terminological conventions, is related to game theory, theories of learning, and to the field of language games.
Subjective and Experience Values of Information in Decision Making: An Experimental Investigation
December 2006 – October 2007

Researcher: Daphne Raban (Graduate School of Management)

In order to make decisions managers are faced with rapidly increasing amounts of data. While this data can be useful, managers increasingly are faced with information overload. Information literacy is the ability of managers to effectively evaluate, select and utilize data. This project will use computer games to simulate decision making processes. It will research both how managers assess the value of information before they get it and how they assess the value of information at a later point in the decision making process. It will also explore how an information system can be used to manipulate how valuable managers believe the information to be.

Simplex Algorithm for Separated Continuous Linear Programming
November 2006 – November 2007

Researcher: Gideon Weiss (Department of Statistics)

This research draws on the recent results of Weiss on a simplex algorithm for the solution of Separated Continuous Linear Programs (SCLP). It will examine two topics: (1) the relation of SCLP to the parametric self dual simplex algorithm for linear programs (LP) and (2) the use of SCLP to solve a fluid flowshop scheduling problem. Research topics will include: the parametric self dual simplex algorithm for LP, the analogy of the path of the PSDS algorithm and the solution of SCLP, and optimal scheduling of a fluid flowshop.
Promoting Education
Interdisciplinary Courses

Cognitive Applications in a Technological Environment
Spring Semester 2004

The coordinator of the seminar was Dr. Hilit Ma’ayan (Department of Psychology). The course consisted mainly of guest lecturers. Each showed aspects of applying cognition, a manifestation of interaction between cognitive psychology and other disciplines or a research area where cognition meets a high-tech environment.

Statistical and Learning Methods in Natural Language Processing
Spring Semester 2004

Dr. Ido Dagan (Bar-llan University) and Dr. Shuly Wintner (Department of Computer Science) presented this course on the empirical learning perspective in Natural Language Processing (NLP). The course reviewed the main NLP tasks that can be addressed in a machine learning or statistical inference framework, covering both supervised and unsupervised tasks, in syntactic and semantic domains. Two main dimensions structured the course: machine learning models that have been used commonly for NLP (such as statistical inference, Hidden Markov Models, Bayesian models, neural networks, boosting and clustering) and the application of learning and statistical methods to a variety of specific NLP tasks (such as part of speech tagging, parsing, word sense disambiguation, text categorization, named entity classification, information extraction, question answering and similarity and structure discovery).

Innovative Computer Applications: Inspiring Research and Development in Education

Prof. Michal Yerushalmy (Faculty of Education) coordinated this workshop consisting of a series of seminars for graduate students of the Faculty of Education and the Department of Computer Science. The seminars were made up of lecturers from the high-tech industry discussing technological innovations applicable to education. During the seminar, current technological developments, the rationale for their development and the possibility of implementation in the field of education were discussed. The goal of the seminar was to help individuals involved in education to bridge the problematic gap between theory and practice. The course provided a theoretical infrastructure that facilitated educators' planning of educational projects for children and adults using high-tech tools.


Mathematical and Computational Methods in Neuroscience
Spring Semester 2004

This course for graduate students was given by Dr. Larry Manevitz (Department of Computer Science). The course was an introduction to mathematical neuroscience and focused on some of the mathematical tools and applications being developed and applied in the wake of recent advances in brain science.
Artificial Intelligence Planning
Summer 2004

The course was given by Dr. Meirav Hadad (CRI) who was a postdoctoral senior visitor at CRI. The course covered applications to robotics, autonomous software agents and integration of planning techniques.

Introduction to Cryptography
Fall Semester 2004

This new course was delivered by Dr. Benny Pinkas (Department of Computer Science). The course was an introduction to the basic theory and practice of cryptographic techniques. Topics covered included: encryption (secret-key and public-key), digital signatures, secure authentication, secret sharing and cryptographic protocols.

Distributed Artificial Intelligence
Fall Semester 2004

The course was delivered by Dr. Meirav Hadad (CRI). The course introduced students to the notion of an agent. It led to an understanding of what an agent is, how one may be constructed and how agents can be made to cooperate effectively with one another to solve problems. The practical component of the module was based on the many Java agent frameworks currently available.

Combinatorial Algorithms
Fall Semesters 2004 – 2006

This weekly seminar for graduate students was delivered by Prof. Moshe Lewenstein (Bar-Ilan University) and addressed such topics as: pattern matching, tree structures and advanced data structures.

Virtual Reality in Rehabilitation Workshop Series
Academic Years 2004 – 2006

The series of workshops regarding innovations of virtual reality in rehabilitation was made possible by a grant from The United States - Israel Science and Technology Foundation (USISTF) in collaboration with the University of Southern California. Lecture topics included: “Haptics: Science, Technology, and Applications” by Prof. Mandayam A. Srinivasan (Massachusetts Institute of Technology), “Applications of Virtual Reality to Special Education and Rehabilitation” and “A SWOT Analysis of the Field of Virtual Rehabilitation” by Prof. Albert A. “Skip” Rizzo (University of Southern California), “Brain-Computer Interface in the CAVE” by Dr. Doron Friedman (University College of London), “Evaluation and Retraining of Driving Skills in Clients with Disabilities” by Dr. Barbara Mazer (McGill University), “Virtual Work Simulation” by Prof. Len Motheson (Washington University) and a series of talks on “A Critical Look at New Approaches to Neurological Rehabilitation” by Prof. Carolee J. Winstein (University of Southern California).

Games are Serious Business
Academic Years 2004 – 2006

This seminar series was organized by Dr. Daphne Raban (Graduate School of Management) and included lectures on the application of games in various fields of research: computer science, business, social dilemmas, political science, rehabilitation and education. From an academic standpoint, games are versatile because they

can be used both for research and for teaching/training. Lecture topics included: “What is Game Theory All About?” by Robert Yisrael Aumann (Hebrew University), “Six (Psychological) Footnotes Regarding Game Theory” by Ramzi Suleiman (University of Haifa), “Homo Ludens” by Haim Shafir (Shafir Games Inc.), “Choice of Routes in Traffic Networks: Experimental Tests of the Braess Paradox” by Amnon Rapoport (University of Arizona), “Business Games as Research Laboratories” by Tel Ben-Tzvi (Tel Aviv University), “What Are Your Kids Doing in their Free Time? Digital Gaming World for Children: A Profile of a Culture in the Making” by Yoram Eshet (Open University) and “Instinctive and Cognitive Reasoning: A Study of Response Times” by Ariel Rubinstein (Tel Aviv University). An expert panel about “Using Games in Israeli Business Schools and in Management Education,” organized jointly with Sheizaf Rafaeli (Graduate School of Management), was held on December 29, 2004 and excerpts of the lectures were broadcast on the Israeli Academic Channel.

Distributed Algorithms
Summer 2005

This course was given by Prof. Eli Gafni (University of California, Los Angeles). The main topics of the summer course included: synchronous and asynchronous shared-memory (SM) and message-passing (MP) models, equivalence between SM and MP, impossibility of two processors wait-free consensus in asynchronous SM and the Borowsky-Gafni (BG) simulation.

Non-Linear Models and Their Computer Realization
Spring Semester 2006

This course was given by Dr. Vladimir Rovenski (Department of Mathematics). Non-linear models and their presentations using the Maple computer algebra system were studied on two levels, basic and advanced. Topics at the basic level included: basic techniques from linear algebra and analysis (series and asymptotical expansions), linear models and methods of their investigation (Cauchy and boundary value problems), integral equations (Wiener-Hopf method), non-linear models and geometrical methods of their investigation (bifurcations, attractors, fractals, chaos, etc.). Topics at the advanced level included: asymptotical, perturbations, etc. and applications: algebraic equations, ordinary differential equations (Duffing, Riccati, Mathieu, etc.). Gassinsky and Rovenski wrote the textbook “Non-linear Models and Computational Methods” based on this course.

Introduction to Computational Semantics
April 25 – May 18, 2006

Prof. Shalom Lappin (King’s College, London) taught this course. The course provided an introduction to the basic concepts and methods of computational semantics within a logic programming framework. The course covered the following topics: encoding meanings in first-order logic, model checking for first-order formulas, representing the compositional semantics of natural language sentences in the higher-order logic of a typed lambda calculus, interpreting noun phrases as generalized quantifiers and expressing natural language inference through theorem proving.

Qualitative User Research and User Experience
February 18 – 22, 2007

This course was taught by Dr. Leena Eronen (Helsinki University of Technology, Finland). It covered the basics of qualitative user research. Qualitative user research and user experience methods are among the key competences in product development and new product design. These methods enable the provision of better products and
services while providing more control over design and more accurate information for the decision makers. User friendly technologies, in turn, create positive feedback among users at work and at leisure. This trend has been recognized by the industry and it has created increased demand for people with user centered skills. The course taught how to keep user research simple, yet innovative and effective. The students learned how to apply user data to create new product and service concepts. The research methods used were: interviews, focus groups, case studies, mystery shopper, ethnography, field research, observation, usability test and brainstorming for new product concepts. This event was organized by Dr. Tsvi Kullik (Dept. of Management Information Systems) and Dr. Irith Ben-Arroyo Hartman (CRI).

**Seminars for Leading High School Computer Science Teachers**

The Second, Third and Fifth Seminars for Leading High School Computer Science Teachers


The seminars were organized by CRI together with Machshava (The Israeli National Center for Computer Science Teachers), in partnership with the Technion – Israel Institute of Technology and the Weizmann Institute. The goals of the summer seminars were: encouraging the exchange of ideas and strengthening ties among participants, integrating teachers from diverse backgrounds, exposing participants to state-of-the-art issues in computer science that are not usually addressed in the high school curriculum and motivating and rewarding teachers for initiating pedagogical workshops for colleagues, or other contributions to the computer science teachers’ community. These goals were met each year. The teachers reported that the conference provided an ideal forum to share and address with typical classroom problems in teaching computer science. As a result of the seminars, some teachers have taken the initiative of organizing new workshops for their colleagues in their communities and developing new materials for the classroom. Furthermore, participants in the conferences have gone on to publish academic articles and to present their experience at national teachers’ conferences.
Scholarships

Undergraduate Students

CRI Scholars Program
Academic Years 2004 – 2005

The program consisted of monthly meetings in which hosted lecturers discussed the way in which computers are used by various professional and social groups. The seminar dealt with such questions as: “what are the special needs and applications relevant to each profession,” and “how do these professions overcome the special problems they face.” Similarly, socio-demographic groups and the special needs and uses they have for technology were explored. These included religious, cultural or linguistic sensitivities that require special adjustments to technology.

Graduate Students

CRI supports scholarships for approximately 15 graduate students per year who are engaged in independent research. Students who contribute papers to national and international conferences receive partial support for their participation and travel.
**Collaboration**

**ITC-irst, Center for Scientific and Technological Research, Trento, Italy**

The collaboration project, “Innovative Technologies for Human Development,” between the University of Haifa and ITC-irst in Trento, Italy was initiated in July 2003 and completed in February 2007. A new, expanded collaboration agreement was signed in February 2007.

The following is a list of the components of the “Innovative Technologies for Human Development” project.

**Museum Visitors’ Guide Testbed**

Researchers from Israel: Shlomo Berkovsky, Dina Goren-Bar, Ariel Gorfinkel, Sadek Jbara, Yaakov Kahanov, Nadav Kashtan, Shahar Katz, Tsvi Kuflik, Larry Manevitz, Ofra Rimon and staff at The Hecht Museum, Julia Sheidin and Pnina Soffer

Researchers from Italy: Adriano Albertini, Paolo Busetta, Alessandro Cappelletti, Ilenia Graziola, Matteo Pedrotti, Cesare Rocchi, Oliviero Stock and Massimo Zancanaro

This work focuses on an exhibition developed at the Hecht museum. It demonstrates technologies first developed at ITC-irst, transferred to Haifa and integrated with University of Haifa researchers’ work. One main objective of the research is to provide an initial tool for a small group of visitors which encourages a shared experience in the museum.

The project includes the development of a mobile, adaptable and personalized museum visitors’ guide for the Hecht museum. This intelligent museum guide is a hand-held computer that visitors use as they tour the museum. It teaches visitors about the exhibits and learns about the visitors. The guide is able to quickly create a museum visit which is best suited to each visitor’s personal interests. It can pinpoint a visitor’s location in the museum, find out what interests each visitor, play video clips and explanatory presentations and enable communication with friends in another part of the museum. Each visitor will have a different experience, tailored to his interests. The museum visitor can communicate with other visitors who have the guide by using “digital sticky notes”. Using this tool one user can leave a message for another user at an exhibit. When the second user visits that exhibit a message such as, “those necklaces are gorgeous,” will pop up on his or her handheld computer. At the end of a visitor’s tour of the museum the guide summarizes the visit. It also
asks each visitor to fill out a virtual questionnaire and give recommendations to improve future museum visits.

The museum visitors’ guide demonstrates several novel technologies and research results in the areas of ubiquitous user modeling, user modeling mediation, group cultural activity, agent-based software engineering and user interfaces. Additional research included the evaluation of the contribution of technology to learning in the museum.

CRI has put a video online which includes more information about this project. Go to: http://tinyurl.com/24u6bp and click on “CRI TRENTO Intelligent Museum Guide”.

**Enhancing Social Communication in High-Functioning Children with Autism through a Co-Located Interface**

Researchers from Israel: Nirit Bauminger, Eynat Gal, Dina Goren-Bar, Judy Kupersmitt, Patrice L. (Tamar) Weiss and Rachel Yifat

Researchers from Italy: Fabio Pianesi, Oliviero Stock and Massimo Zancanaro

Autism is a complex developmental disability with symptoms that usually emerge during the first years of life. Children with autism often have difficulties in verbal and non-verbal communication, social interactions, and leisure or play activities. Those with high functioning autism (HFA) have a close to normal IQ, and some even exhibit exceptional skill or talent in specific areas. In this research, we use the Diamond Touch interface in the context of a therapeutic intervention aimed at enhancing the ability of children with HFA to interact in a social situation that leads to collaborative story-telling. The results of the pilot study suggest that this technology appears to have a positive effect on improving the quality of social interaction as well as on decreasing the repetitive behaviors that are typical of autism. These positive effects appear to also transfer to other tasks. We hypothesize that this is due to the fact that the setting requires that, at crucial points during the story construction, the subjects agree on relevant steps to be taken and make this physically explicit through joint actions. In other words, the very nature of the scenario requires children with HFA to engage in a number of essential social behaviors which they often refrain from.

**A Collaborative Table for Narration Negotiation and Reconciliation in a Conflict**

Researchers from Israel: Zvi Eisikovits, Dina Goren-Bar, Chaya Koren and Patrice L. (Tamar) Weiss

Researchers from Italy: Alessandro Cappelletti, Cesare Rocchi, Oliviero Stock, Daniel Tomasini and Massimo Zancanaro

This study aims to explore the role of a technology for enforcing collaboration in shifting attitudes of participants in conflict via a narration task. The general claim is that participants may achieve a greater understanding of, and appreciation for, the other’s viewpoint under conditions that support partaking in a joint task and creating a shared narration. The application-oriented specific goal is to provide technology that can help shift attitudes of youth in conflict towards more positive views of each other via interactions and joint actions that take place during a collaborative narration task. The work is based on two cultural elements: conflict resolution theory and the design of a collaborative tabletop interface aimed specifically for the task. The two main research questions are: (1) "Does a face-to-
face collaboration-enforcing interface for negotiating narration facilitate a change of attitudes and contribute to reconciliation?" and (2) “Can this interface be an alternative to a typical face-to-face moderated discussion?"

**Automated Language Processing with Applications for Cultural Heritage Appreciation**

Researchers from Israel: Ido Dagan, Nurit Melnik, Danny Shacham, Idan Szpektor and Shuly Wintner

Researchers from Italy: Bonaventura Coppola, Christian Girardi, Alfio Gliozzo, Milen Kouylekov, Alberto Lavelli, Emanuele Pianta, Lorenzo Romano, Carlo Stropparava and Hristo Tanev

The project is divided into two main components:

1) Knowledge Learning Approaches for Natural Language Processing

The goal of this project is to learn, and eventually utilize, knowledge about the variability of semantic expression in natural language. This goal must be addressed by practically all language understanding applications, such as Question Answering (QA), Information Extraction (IE), Information Retrieval (IR), text summarization and Machine Translation. We focus on developing an unsupervised approach for learning from the web entailment relations between lexical-syntactic templates.

2) Showcase for Archaeological Domain

This project demonstrates the applicability of the Textual Entailment Paradigm for semantic-oriented Information Retrieval, and demonstrates handling of queries that contain specific relations between terms. Furthermore, cross-lingual Information Retrieval capabilities are demonstrated, capitalizing on Hebrew language resources and tools.

**User Modeling and Advising for Tourism: Negotiation and Recommender Systems**

Researchers from Israel: Pavel Bekkerman, Martin C. Golumbic and Sarit Kraus

Researcher from Italy: Francesco Ricci

The project focuses on developing methods to integrate the supplier’s preferences into the current generation of recommendation systems. As an application to this research, we aim to incorporate a negotiation facility that can combine recommendations offered to both suppliers and customers into the existing Trip@vice technology of the travel recommender systems (NutKing and Dietorecs) that have been developed at eCTRL, ITC-irst (Trento, Italy).

**Ubiquitous User Modeling: Importing Remote User Model for Personalized Services**

Researchers from Israel: Shlomo Berkovsy, Ariel Gorfinkel, Tsvi Kuflik and Larry Manevitz

Researcher from Italy: Francesco Ricci

The main goal of this project is to develop a generic mediating mechanism for incorporating partial user models collected by various personalized service providers in a ubiquitous environment. The mediating mechanism will facilitate user modeling information sharing through translation and integration of partial user models built by various service providers. The input for the mediating mechanism is the available information about a given user, while the output is the enriched unified user model, needed by the target personalization service. This mediation of partial models will allow the target service to enrich its user model and will facilitate provision of more accurate personalization.
Reasoning about Graphs with Application to Temporal and Spatial Reasoning
Researchers from Israel: Claudia Goldman-Shenhar, Martin C. Golumbic, Marina Lipshteyn, Shimon Shrem and Michal Stern

This project deals with applications to decentralized control, where processes lack a global view of the system state and none can centrally control the global behavior. For example, time and spatial constraints may prevent agents acting locally from continuously sharing information although cooperation may improve their group performance. Another example consists of a network of cameras that need to decide how to position themselves next to best monitor a situation when none of them can, alone, see the global scene. Effectively controlling networks or ubiquitous systems and planning for successfully performing operations are among other challenging areas for which the study of decentralized control is essential.

Markov Decision Process for Group Advise
Researcher from Israel: Claudia Goldman-Shenhar

The goal of this project is to define the theoretical basis that can help extend the PEACH technology for museum visits, based on a Markov decision process approach. In order to promote interaction among visitors coming to a museum in a group, a decentralized recommender system is needed. The research is aimed at studying decision-theoretic planning for groups under time constraints with possibly conflicting goals. Algorithms are designed that will be able to recommend actions to a group of people visiting a museum taking into account time constraints imposed on the group, different priorities of the visitors and uncertainty in the environment.

Chess Game Commentator
Researcher from Israel: Shay Bushinsky
Researcher from Italy: Bruno Lepri

The objective of the project is to build a chess commentator that can disperse commentary to many users. An asymmetric depth search algorithm has been designed and implemented for discovering tactical shots in a given chess position. Based on the infrastructure designed, the commentator has shifted in the direction of a distributed artificial intelligence agent system, which can apply different commentary levels both of human and of specialized computers in position analysis. A shell prototype was produced that can be used to deliver expert chess game commentary from different sources and perspectives.
University of Waterloo, Canada

A new academic and research exchange program in computer science has been developed between the University of Waterloo, Canada and the University of Haifa, expanding study opportunities for undergraduate and graduate students as well as research possibilities for faculty at both universities.

The University of Waterloo-Haifa International Experience Program has been made possible by a $500,000 gift from Canadian business leaders Heather Reisman (President and CEO of Indigo Books and Music) and her husband Gerald Schwartz (Chair and CEO of Onex corporation).

The donation, to be spread over five years, will annually fund more than a dozen academic and research exchanges involving undergraduate students, graduate students and faculty members in computer science at both institutions.

Within the agreement, non-Hebrew-speaking University of Waterloo students with little personal experience of Israel will live in Haifa for a four-month research term and have the opportunity to attend a Hebrew language program. English-speaking students from the University of Haifa will spend one study term and one research term at the University of Waterloo. Graduate students and faculty members at both institutions will be invited as visiting scholars, taking part in key research projects for approximately one month each. The links they establish will form the basis for expanded research connections, perhaps involving other universities in Israel and beyond.

Sorbonne, France

On May 19, 2006 a scientific collaboration agreement was signed between the University of Haifa and the University of Paris-Sorbonne Paris IV (the Sorbonne). The aim of the agreement is to encourage cooperation and scientific exchange between the two institutions. The collaboration was launched with a successful workshop on computational linguistics held on May 18, 2006. Lectures in recent developments in computational linguistics were given by four visitors from the Sorbonne: Prof. Jean-Pierre Desclés, Prof. Claude Montacié, Dr. Delphine Battistelli, and Dr. Brahim Djioua. The workshop included presentations on topics in computational linguistics given by CRI Haifa project participants.

A brainstorming session held at CRI on May 19, 2006 including the President of the Sorbonne, Prof. Jean-Robert Pitte and the French Embassy Attaché for Higher Education, Mr. Alex Cormanski, resulted in the identification of areas of possible collaboration between the University of Haifa and the Sorbonne. These areas include: computational linguistics, French literature, oriental music and applied languages.

Florida Atlantic University, USA

A collaboration agreement was signed in 2006 between CRI and Florida Atlantic University, focusing on the area of artificial intelligence. An international symposium on artificial intelligence and mathematics is co-organized every two years in Fort Lauderdale, Florida by Prof. Martin C. Golumbic (CRI) and Prof. Frederic Hoffman (Dept. of Mathematics, Florida Atlantic University).
Looking Ahead: Future Activities of CRI

**Formal Approaches to Language Acquisition**
October 7, 2007

This workshop will be organized by Dr. Shuly Wintner (Department of Computer Science). The keynote speaker will be Ewa Dabrowska (School of English Literature, Language and Linguistics, University of Sheffield, UK). Her talk is entitled, “From Formula to Schema: Syntactic Development in a Usage-Based Framework”.

**ALGO 2007**
October 8 – 12, 2007

This year CRI will be one of the nine co-sponsors of ALGO 2007, a large international conference which will be held in Eilat. It includes the fifteenth annual European Symposium on Algorithms (ESA) and the fifth Workshop on Approximation and Online Algorithms (WAOA). This year it will also include the Pre-ESA Graduate Student Get-together (PEGG), an event intended to encourage interaction among graduate students.

**IBM-Research: Haifa Verification Conference 2007**
October 23 – 25, 2007

HVC 2007 is the third annual conference dedicated to advancing the verification and testing of both hardware and software. It is organized by the IBM Haifa Research Lab and sponsored by CRI. The conference provides a forum for academia, industry and the research and development community to meet. They are able to share their work, exchange ideas and discuss the challenges and future directions of verification for hardware, software, and hybrid systems. The keynote speakers will be Bob Bentley (Intel Corporation) and Aarti Gupta (NEC Labs America).

**The first Danish-Israeli Symposium on Translational Research in Sensory Processing**
November 7, 2007

This symposium will be organized by Dr. Dorit Pud [Department of Nursing] and Prof. Lars Arendt-Nielsen [Center of Sensory-Motor Interaction, University of Aalborg, Denmark]. In recent years there has been a great deal of interest and progress related to translational research, i.e., the transformation of scientific discoveries arising from laboratory, clinical or population studies into clinical applications to reduce disease incidence, morbidity and mortality. Translational research has also increased dramatically in the areas of neural plasticity, neurorehabilitation and neuroprotection. The main purpose of this symposium is to disseminate and expand the knowledge on cognitive, sensory and motor processing, neuroplasticity and translational research. This symposium offers a special opportunity to address issues related to brain mechanisms underlying cognitive, sensory and motor processing. This symposium is unique in its multidisciplinary and bi-national collaborative approach. As such, it should serve as a springboard for the advancement of medical intervention and neurobehavioral rehabilitation and for future collaborative studies.

Sponsored by CRI, this conference is organized by the Faculty of Social Welfare and Health Sciences and the Center for Sensory-Motor Interaction, University of Aalborg, Denmark.
Expert Workshop on Geometric Combinatorics
November 19 – 22, 2007

This workshop will be organized by Toufik Mansour (Department of Mathematics) and Alek Vainshtein (Department of Computer Science). This will be a small scale conference for selected experts in the field of lattice paths, an emerging area of research that integrates physics, biology, computer science and mathematics. Confirmed speakers include: Prof. Eva-Maria Feichtner (University of Stuttgart), Prof. Dmitry Kozlov (University of Bremen) and Prof. Sergey Yuzvinsky (University of Oregon).

Tenth International Symposium on Artificial Intelligence and Mathematics
January 2008

CRI will be a co-sponsor of this biennial conference organized in collaboration with Florida Atlantic University and held in Fort Lauderdale, Florida. Started by Martin C. Golumbic (CRI), the International Symposium on Artificial Intelligence and Mathematics fosters interaction between mathematics, theoretical computer science and artificial intelligence. The editorial board of the Annals of Mathematics and Artificial Intelligence serves as the permanent Advisory Committee. The symposium attracts participants from a variety of disciplines, thereby providing a unique forum for scientific exchange. The three-day symposium includes invited speakers, presentations of technical papers and special topic sessions.

Expert Workshop on Boolean Functions in Memory of Peter L. Hammer
January 27 – February 1, 2008

CRI will organize the first memorial workshop on Boolean functions in memory of Professor Peter Hammer. This workshop commemorates Professor Hammer’s tragic death in a car accident on December 27, 2006. Professor Hammer delivered the Rothschild Lecture at CRI’s Third Haifa Workshop on the Interdisciplinary Applications of Graph Theory, Combinatorics and Algorithms in May 2003. Peter Hammer was an expert in Boolean and Pseudo Boolean functions. His extensive research touched on many fields including: discrete mathematics, logic, graph theory, applied operations research, social sciences, medical sciences and statistics. He was the founding editor of five prestigious scientific journals: Discrete Mathematics, Discrete Applied Mathematics, Annals of Discrete Applied Mathematics, Annals of Operations Research and The Monograph Series on Discrete Mathematics and Applications (of SIAM).

**CICLing 2008 - Ninth International Conference on Intelligent Text Processing and Computational Linguistics**
February 17 – 23, 2008

This conference focuses on computational linguistics research and intelligent text processing. Keynote speakers will include Ido Dagan (Department of Computer Science, Bar-Ilan University), Alon Lavie (School of Computer Science, Carnegie Mellon University) and Kemal Oflazer (Faculty of Engineering and Natural Sciences, Sabanci University, Turkey).

The conference is co-organized by CRI and the Natural Language and Text Processing Laboratory of the Center for Computing Research, National Polytechnic Institute, Mexico. It will be hosted by CRI and the Computational Linguistics Group.

**Eighth Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics and Algorithms**
May 2008

This workshop has been organized by CRI every year since 2001. It attracts leading researchers and students from all the universities in Israel, as well as from abroad.

**The Fourth Haifa Annual International Stringology Research Workshop**
This workshop will be organized by Prof. Gad M. Landau (Department of Computer Science). This workshop will include talks on stringology related topics including: pattern matching algorithms, algorithms for computational biology, data compression, data structures and other applications of pattern matching algorithms. This is the fourth time since 2004 that CRI will organize this workshop.

**Cognitive and Computational Models of Emotion**
Spring Semester 2008

Prof. Andrew Ortony (Departments of Psychology, Education and Computer Science, Northwestern University) and Prof. Martin C. Golumbic (CRI) will teach this interdisciplinary course. While it is customary in lay circles to make a sharp distinction between matters of the head (cognition) and matters of the heart (emotion), psychologists and cognitive scientists see all manner of connections between cognition and emotion. This course will examine some of these connections as they are played out in psychological theories of emotion and their manifestation in artificial intelligence applications, generally referred to as affective computing.

**Innovative Computer Applications: Inspiring Research and Development in Education**
Spring Semester 2008

Prof. Michal Yerushalmi (Faculty of Education) and Dr. Dani Ben-Zvi (Faculty of Education) will coordinate this course, the fourth in a series of annual one semester courses. This course will bring together leaders in high-tech with graduate students from both the Faculty of Education and the Department of Computer Science. It will help future educators to bridge the gap between theory and practice. The students will plan computer-based educational projects for children and adults.
Appendix
Workshops, Conferences and Symposia

Below is a list of the workshops, conferences and symposia sponsored by CRI for the period 2004-2007. The list does not include guest lectures and seminars. More information about all these events may be found at the CRI website: http://www.cri.haifa.ac.il.

2004

February 2-4, 2004: Conference on the Value of Information in Networked Contexts

February 9-11, 2004: Workshop of the ITC-irst – University of Haifa Collaboration: "Artificial Intelligence Research and Innovative Technologies for Human Development," held in Povo (Trento), Italy


March 15-17, 2004: Workshop: "The Use of Computers in Psychiatry"

March 17-18, 2004: Second Symposium on "Virtual Reality and Rehabilitation: Algorithms, Avatars, and Applications"

March 21-23, 2004: Special Lecture Series in Mathematics and Computer Science: "The RSK Algorithm" by Prof. Richard Stanley

March 25, 2004: Sixteenth Israel Symposium on Computational Mechanics (ISCM-16)

April 25-30, 2004: France-Israel Expert Workshop on Graph Classes and Algorithms

May 2, 2004: Semantic Web Workshop (with the Jewish Agency), held in Jerusalem

May 3-5, 2004: Fourth Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics and Algorithms

May 9-14, 2004: Stringology Expert Workshop


May 27-June 4, 2004: Workshop on "Recent Developments in Discrete Metric Spaces: Theory and Algorithmic Applications"
June 6-11, 2004: Interdisciplinary Expert Workshop on Intensity-Modulated Radiation Therapy (IMRT), Medical Imaging, and Optimization Theory

June 21-23, 2004: Second Seminar for Leading High-School Teachers


November 1-4, 2004: Inauguration of the CRI – Dept. of Computer Science Research Seminars for year 5765

December 5-7, 2004: CSStat ’04 – Third Winter Workshop on Statistics & Computer Science: Scientific Applications of Bayesian Analysis

December 16, 2004: Workshop: "Law, Technology and All That Spam"

2005

January 9-11, 2005: First International Meeting of the Haifa Forum of Brain and Behavior: "Neurobiology and Modulation of Memory Formation"

January 10, 2005: Virtual Reality in Rehabilitation Lecture: "Evaluation and Retraining of Driving Skills in Clients with Disabilities"

January 12-13, 2005: Conference: "Ambient Intelligence – Conceptual and Practical Issues"

March 7-9, 2005: Symposium: "Virtual Reality, Associated Technologies and Rehabilitation"

March 16, 2005: Special CRI Combinatorics Seminar: "The Subtransversal Criterion for Hypergraphs and Its Applications"

March 30, 2005: Workshop: "Pattern Recognition in the Brain and in Computational Sciences"

April 3-8, 2005: Second Haifa Annual International Stringology Research Workshop (with the Israel Science Foundation)

May 16-19, 2005: Fifth Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics and Computing

May 17, 2005: Workshop on "The Past, Present and Future of Oblivious Transfer"

May 25-June 1, 2005: Roger Schank, Series of Talks

May 29-June 3, 2005: Expert Workshop on Permutation Patterns

June 27, 2005: Workshop: "Advances in Recommender Systems"

June 28-30, 2005: The 8th Biennial Israeli Symposium on the Foundations of Artificial Intelligence (BISFAI-05)
June 30, 2005: Workshop on "Computing with Emotions"

July 5-7, 2005: Third Seminar for Leading High-School Teachers

November 13-16, 2005: IBM Verification Conference 2005

2006

March 2, 2006: Seminar: "Functional Outcomes in Physical Therapy"

March 9, 2006: Colloquium: "Speed Scaling with Precedence Constraints"

March 29, 2006: Haifa Law & Technology Center: e-Commerce Conference

May 7-12, 2006: Third Haifa Annual International Stringology Research Workshop [with the Israel Science Foundation]

May 15, 2006: Workshop: "BioMedical Informatics: Artificial Intelligence and Cognitive Perspectives"

May 18, 2006: Sorbonne-Haifa Workshop on Computational Linguistics


May 28-31, 2006: Sixth Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics and Computing: Combinatorial Optimization

June 20-22, 2006: Workshop and Symposium: "Virtual Reality, Associated Technologies and Rehabilitation"


October 15-16, 2006: Israeli Association for Information Systems Convention (ILAIS)

October 16, 2006: Ninth Israeli Bioinformatics Symposium


November 9, 2006: Neurocomputation Laboratory Day

December 19, 2006: Workshop: "Machine Learning and Natural Language Processing"

December 21, 2006: Workshop: "Search Engines"

Left to Right: Rona Perkis (CRI Coordinator) and Dr. Michal Stern (Academic College of Tel Aviv-Jaffa)
2007


February 12-13, 2007: Concluding Workshop of First Trento-Haifa Collaboration Project

February 18-22, 2007: Qualitative User Research and User Experience

February 29-March 1, 2007: Distinguished Lecture Series in Mathematics and Computer Science hosts Prof. Avi Wigderson

Wednesdays in March, 2007: Faculty Seminar on Computational Cognition

March 14, 2007: Computer Science Colloquium: "On the Separation and Equivalence of Paging Strategies: LRU is the Sole Optimum"

Academic Year 2006-7: Faculty Seminar Series on Research Methods

March 20, 2007: Seminar: Clustering Gene Expression Data Using Graph Separators

May 14-16, 2007: Seventh Haifa Workshop on Interdisciplinary Applications of Graph Theory, Combinatorics and Algorithms

June 17-18, 2007: Workshop: "Networks Analysis"


June 20-22, 2007: The 9th Bar-Ilan Symposium on the Foundations of Artificial Intelligence (BISFAI-07)

July 4-5, 2007: Workshop: "Structural Equation Modeling"

July 10-12, 2007: Fifth Seminar for Leading High School Teachers
Publications

The publications below are listed by laboratory.

Computational Linguistics Laboratory

2004


2005


**2006**


N. Melnik. From 'hand-written' to computationally implemented HPSG theories, *Research on Language and Computation*, accepted for publication.


**2007**


Stringology Laboratory

Articles in Refereed Journals

2004


2005


2006


Book Chapters


Articles in Proceedings of Refereed Conferences

2004


2005


**2006**


**Accepted for Publication**


Graph Algorithms and Theory Laboratory

Books


Edited Books


Edited Journal Special Issues


Papers in Refereed Journals

2004


2005


2006


2007


**Papers in Refereed Proceedings**


In Preparation, Submitted or Accepted


M.C. Golumbic, M. Lipshteyn, M. Stern. The k-edge intersection graphs of paths in a tree, Discrete Applied Math (accepted).


Neurocomputation Laboratory

2004

M. Maimon, L. Manevitz, A simulation tool for modeling the influence of anatomy on information flow using discrete integrate and fire neurons, poster, Neurobiology and the Modulation of Memory Formation, Brain and Behavior Meeting, 2004.

2005


D. Hardoon, L. Manevitz, One-class machine learning approach for fMRI analysis, PREP-2005.

D. Hardoon, L. Manevitz, Classifying cognitive tasks to MRI data using machine learning techniques, The 8th Biennial Israeli Symposium on the Foundations of Artificial Intelligence (BISFAI-05), Haifa, Israel, June 2005.


2006


D.R. Hardoon, L. Manevitz, Reading the mind: fMRI analysis via one-class machine learning techniques, DIMACS Workshop on Data Mining, Systems Analysis and Optimization in Neuroscience, 2006.

M. Maimon, L. Manevitz, A simulation tool using discrete integrate and fire neurons in very large simulated networks, DIMACS Workshop on Data Mining, Systems Analysis and Optimization in Neuroscience, 2006.

2007


S. Berkovsky, Y. Eytani, L. Manevitz, Collaborative filtering based on content addressing, Lecture Notes in Business Information Processing: Special Issue on Enterprise Information Systems, [accepted, to appear].


S. Berkovsky, A. Gorfinkel, T. Kuflik, L. Manevitz, Case-based to content-based user model mediation and its effectiveness, The 9th Bar-Ilan Symposium on the Foundations of Artificial Intelligence (BISFAI-07) [abstract only p. 17].

Z. Eviatar, O. Peleg, H. Hazan, L. Manevitz, Differences and interactions between cerebral hemispheres when processing ambiguous homographs, The 9th Bar-Ilan Symposium on the Foundations of Artificial Intelligence (BISFAI-07) [abstract only p. 18].


M. Maimon, L. Manevitz, A simulation tool for modeling the influence of anatomy on information flow using discrete integrate and fire neurons, Journal of Combinatorial Optimization [accepted, to appear].


O. Peleg, Z. Eviatar, H. Hazan, L. Manevitz, Differences and interactions between cerebral hemispheres when processing ambiguous homographs, Lecture Notes in Artificial Intelligence, Special Issue on Attention in


**Patents**

Laboratory for Virtual Reality Studies

Journal Publications


Conferences


Publications Related to the Trento-Haifa Collaboration Project

2004


2005


**2006**


**2007**


In Preparation, Submitted or Accepted

S. Berkovsky, T. Kuflik, F. Ricci. Distributed collaborative filtering with domain specialization, RecSys 2007 [accepted].

S. Berkovsky, Y. Eitany, T. Kuflik, F. Ricci. Enhancing privacy and preserving accuracy of a distributed collaborative filtering, RecSys 2007 [accepted].


S. Jbara, T. Kuflik, P. Soffer, O. Stock. Context aware communication services in “active museums”, SWESTE 2007 [accepted].

Publications Related to Other Projects

Books:


Papers

2005


2006


**2007**


**Submitted and In Preparation**

N. Goldschmidt, D. Gordon, The BOXEL Framework for 2.5d data with applications to virtual drive-throughs and ray tracing, *(submitted).*

G. Peleg, G. Katzir, M. Kamara, L. Brodsky, O. Peleg, H. Hel-Or, D. Keren, E. Nevo, Facial expressions in various emotional states in congenitally blind and sighted subjects, *(in preparation for submission to Evolutionary Biology).*
List of Visitors

2004

Robert Astur, Yale University
Alberto Apostolico, Purdue University
Robert Israel Aumann, Hebrew University
Susie Bayarri, Valencia University
Adi Ben-Israel, Rutgers University
Gary Benson, Boston University
James Berger, Duke University
Thomas Bortfeld, Harvard University
Jose Maria Carazo, Universidad Autonoma de Madrid
Moses Charikar, Princeton University
Boris Choy, University of Technology, Sydney, Australia
Maria Chudnovsky, Princeton University
Guido Consonni, University of Pavia, Italy
Maxime Crochemore, Université Marne-la-Vallée
Arthur P. Dempster, Harvard University
Yefim Dinitz, Ben-Gurion University
Avraham Eisbruch, University of Michigan
Leah Epstein, Interdisciplinary Center Herzliya
Funda Ergun, Case Western Reserve University
Michael Erlihson, Technion
Michael C. Ferris, University of Wisconsin
Stephen E. Fienberg, Carnegie Mellon University
Eldar Fisher, Technion
Yuval Flicker, Ohio State University
Leszek Gasieniec, University of Liverpool
Wally Gilks, Cambridge University
Ken Graap, Virtually Better Inc., USA
David Hardoon, University College London
James Hendler, University of Maryland
Gabor T. Herman, City University of New York
Hunter Hoffman, University of Washington
Hagai Ilani, Negev Academic College of Engineering
Piotr Indyk, MIT
Ilya Ioschikhes, Ohio State University
William Johnson, Texas A&M University
Emily Keshner, Northwestern University
Fima Klebaner, Monash University, Australia
Evelyne Klinger, University of Caen, France
Robert Krauthgamer, IBM Research, Almaden
Attila Kuba, University of Szeged, Hungary
Mark Langer, Indiana University
Eva K. Lee, Georgia Institute of Technology, USA
James Lee, University of California at Berkeley
Manor Mendel, University of Illinois at Urbana-Champaign
Peter Mueller, University of Texas
David Mumford, Brown University
Assaf Naor, Microsoft, USA
Eli Noam, Columbia University
Andrew Ortony, Northwestern University
Kunsao Park, Seoul National University
Ariel Pashtan, University of Illinois at Chicago
Marianna Pensky, University of Central Florida
Jose Quintana, 2BestSystems, Italy
Satish Rao, University of California at Berkeley
Ronald L. Rardin, Purdue University
Giuseppe Riva, Instituto Auxologico Italiano, Milano, Italy
Albert "Skip" Rizzo, University of Southern California
Gary L. Rosner, University of Texas
Dan Roth, University of Illinois at Urbana-Champaign
Fabrizio Ruggeri, CNR IMATI, Milano, Italy
Marie-France Sagot, Inria and Universite Claude Bernard, France
Cenk Sahinalp, Simon Fraser University, Canada
Jeanette Schmidt, Stanford University
Boris Shapiro, University of Stockholm
Ehud Sharlin, Osaka University, Japan
Mike Sherris, University of New South Wales, Sydney, Australia
Ariela Sofer, George Mason University
Mandayam A. Srinivasan, MIT
Oliviero Stock, ITC-irst, Trento, Italy
Barbara Strassman, College of New Jersey
Andrew Todd-Pokropek, University College London
Gyorgy Turan, University of Illinois at Chicago
Joseph Turow, University of Pennsylvania
Herman Van Dijk, Erasmus University, Rotterdam, Netherlands
Marina Vannucci, Texas A&M University
Hal Varian, University of California at Berkeley
Rephael Wenger, Ohio State University
Mike West, Duke University
Anja Wille, ETHZ Computational Laboratory, Switzerland
Andrew Yao, Princeton University
Massimo Zancanaro, ITC-irst, Trento, Italy
Assaf Zeevi, Columbia University
Arnold Zellner, University of Chicago

2005
Alberto Apostolico, Purdue University
Shlomo Argamon, Illinois Institute of Technology
Yonatan Aumann, Bar-Ilan University
Rolf Backofen, Institute for Informatics, Germany
Daniele Barbacovi, Istituto agrario di S. Michele all'Adige IASMA, Italy
Judit Bar-Ilan, Bar-Ilan University
Michael Bender, Stony Brook University
Michael Ben-Or, Hebrew University
Gary Benson, Boston University
Adrian Bondy, Université Claude-Bernard Lyon, France
Derek Bridge, University College Cork, Ireland
Robin Burke, DePaul University, Chicago
Alexander Burstein, Iowa State University
Raphael Clifford, King’s College, London
Maxime Crochemore, King’s College, London
Yan Zhong Ding, Georgia Tech, USA
Eric Egge, Gettysburg College
Paolo Ferragina, University of Pisa, Italy
Andras Frank, Eotvos Lorand University, Budapest
Andrea Gaggioli, Instituto Auxologico Italiano, Milano, Italy
Leszek Gasieniec, University of Liverpool
Donald Green, Yale University
Roberto Grossi, University of Pisa, Italy
Barbara Grosz, Harvard University
Gregory Gutin, Royal Holloway University
Yaakov HaCohen-Kerner, Jerusalem College of Technology
Pavol Hell, Simon Fraser University, Canada
Alain Hertz, GERAD – Ecole des HEC, Canada
Silvia Heubach, University of Southern California
Jan Holub, Czech Technical University
Costas S. Iliopoulos, King’s College, London
Robert Jamison, Clemson University
Christos Kaklamanis, University of Patras, Greece
Michael Kaminski, Technion
Martin Klazar, Charles University, Czech Republic
Joseph A. Konstan, University of Minnesota
Richard Korf, University of California Los Angeles
Antonio Kruger, Saarland University, Germany
Gregory Kucherov, LORIA, France
Alon Lavie, Carnegie Mellon University
Parida Laxmi, IBM Watson Research Center, Yorktown
Daniel Lehmann, Hebrew University
Stefano Lonardi, University of California at Riverside
Veli Makinen, University of Helsinki
Giovanni Manzini, University of Piemonte Orientale, Italy
Francesco Marganti, Instituto Auxologico Italiano, Milano, Italy
Barbara Mazer, McGill University
John McCarthy, University of Massachusetts
Silvio Micali, MIT
Luc Moreau, University of Southampton, UK
Laurent Mouchard, University of Rouen, France
Andrew Ortony, Northwestern University
Azaria Paz, Technion and Netanya Academic College
Krishna Palam, Georgia Tech, USA
Igor Pak, MIT
Ariel Pashtan, Aware Networks, USA
David Peleg, Weizmann Institute
Giuseppe (Pino) Persiano, University of Salerno, Italy
Nadia Pistani, University of Pisa, Italy
Amir Pnueli, New York University
Helmut Prendinger, National Institute of Informatics, Tokyo
Michael O. Rabin, Harvard University and Hebrew University
Tal Rabin, IBM, T.J.Watson Research Center
Mathieu Raffinot, Laboratoire Poncelet, Moscow
Francesco Ricci, ITC-irst, Trento, Italy
Giuseppe Riva, Instituto Auxologico Italiano, Milano, Italy
Cenk Sahinalp, Simon Fraser University, Canada
Roger Schank, Socratic Arts, USA
Jeanette P. Schmidt, Polytechnic University, USA
Bart Selman, Cornell University
Simone Severini, University of York, UK
Dennis Shasha, New York University
Saharon Shelah, Hebrew University
Yoav Shoham, Stanford University
William (Bill) Silvert, Portuguese Fisheries Institute, Lisbon
Steven Skiena, Stony Brook University
Rebecca Smith, University of Florida
Richard Stanley, MIT
Einar Steingrimsson, Reykjavik University, Iceland
Oliviero Stock, ITC-irst, Trento, Italy
Gabor Tardos, Renyi Institute of Mathematics, Budapest
Esko Ukkonen, University of Helsinki
Vince Vatter, Rutgers University
Stephane Vialette, CNRS-Université Paris-Sud
Alexander Voiskounsky, Moscow University
Wolfgang Wahlster, German Research Center for AI and Universität des Saarlandes
Julian West, Malaspina University College, Canada
Massimo Zancanaro, ITC-irst, Trento, Italy
Doron Zeilberger, Rutgers University
Shlomo Zilberstein, University of Massachusetts

2006

Rolf Backofen, University of Freiburg, Germany
Jean Bamberger, MIT
Marie Pierre Beal, University of Marne-la-Vallee, France
Daniel M. Berry, University of Waterloo
Gosse Bouma, University of Groningen, The Netherlands
Maria Chudnovsky, Princeton University
Raphael Clifford, University of Bristol, UK
Ann Copestake, University of Cambridge, UK
Maxime Crochemore, University of Marne-la-Vallee, France
Berthold Crysmann, Saarland University, Germany
Thomas Erlebach, University of Leicester, UK
Dan Flickinger, Stanford University
Sergei Fomin, University of Michigan
Martin Forst, Stuttgart University, Germany
Leszek Gasieniec, University of Liverpool, UK
Raffaele Giancarlo, University of Palermo, Italy
Michel Goemans, MIT
Martin Groetschel, ZIB, Germany
Gregory Gutin, University of London
Dennis Hart, FOTO Inc., USA
Jan Holub, Czech Technical University, Prague
Costas S. Iliopoulos, King's College, London
Robert Jamison, Clemson University, USA
Gil Kalai, Hebrew University
Juha Karkkainen, University of Helsinki
Gabor Kassay, Babes-Bolyai University, Romania
Ethan Katsh, University of Massachusetts
Yitzhak Katznelson, Stanford University
Alexandra Kinyon, University of Pennsylvania
Valia Kordoni, University of Saarland, Germany
Gregory Kucherov, CNRS, France
Shalom Lappin, King's College, London
Manny [Meir] Lehman, Middlesex University UK
Mindy Levin, McGill University
Sabrina Mantaci, University of Palermo, Italy
Detmar Meurers, Ohio State University
Stefan Mueller, Breman University, Germany
Shmuel Onn, Technion
Ariel Pashtan, Aware Networks, USA
Uri Peled, University of Illinois at Chicago
David Peleg, Weizmann Institute
Gerald Penn, University of Toronto, Canada
Micha A. Perles, Hebrew University
Nadia Pistani, University of Pisa, Italy
Cinzia Pizzi, University of Padua, Italy
Vera Pless, University of Illinois at Chicago
Mikhail Roytberg, Institute of Mathematical Problems of Biology, Moscow
Cenk Sahinalp, Simon Fraser University, Canada
Andras Sebo, CNRS Grenoble, France
Paul Seymour, Princeton University
David Shmoys, Cornell University
Dina Sokol, Brooklyn College, City University of New York
Harold Somers, University of Manchester, UK
Rob Van Stee, University of Karlsruhe, Germany
Oliviero Stock, ITC-irst, Trento, Italy
Mario Szegedy, Rutgers University
Stephan Thomasse, University of Lyon, France
Alexander Tiskin, University of Warwick, UK
Olga Troyanskaya, Princeton University
Jesse Tseng, CNRS, LORIA, France
Christopher Umans, California Institute of Technology
Gabriel Valiente, Technical University of Catalonia, Spain
Gertjan Van Noord, University of Groningen, The Netherlands
Philip J. Weiser, University of Colorado
Prudence Wong, University of Liverpool, UK
Uri Zwick, Tel-Aviv University

2007
Gil Ast, Tel-Aviv University
Omer Barad, Rosetta Genomics, Inc.
Oded Beja, Technion
Anne Berry, Université Blaise Pascal, France
Daniel M. Berry, University of Waterloo, Cheriton School of Computer Science
Adrian Bondy, Université Claude-Bernard Lyon 1, France
Pam Borghardt, IRMACS, Simon Fraser University, Canada
Daniel G. Brown, University of Waterloo, Canada
Heidi Campbell, Texas A & M University
Irun Cohen, Weizmann Institute
Brian Corrie, IRMACS, Simon Fraser University, Canada
Leena Eronen, Helsinki University of Technology
Trevor Fenner, University of London
Ora Furman, Hebrew University
Gregory Gutin, Royal Holloway University
David Hardoon, University College, London
Dominik Heckmann, Saarland University, Germany
Harrie Hendriks, Radboud Universiteit, The Netherlands
Silvia Heubach, California State University at Los Angeles
Arie Kaufman, Stony Brook University
Alex Lopez-Ortiz, University of Waterloo, Canada
Ross McConnell, Colorado State University
Ramt Mehr, Bar-Ilan University
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