

# The ICSI GAZETTE

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## featured research: neural theory of language

### Neural Theory of Language: ICSI research on the brain and language, from 1988 to the present

The Neural Theory of Language is a comprehensive theory that explores how the human mind learns, understands, and uses language to communicate. It uses computational models and simulations of language and learning to answer basic questions about the production and use of natural language. For the past two decades, ICSI researchers have studied this relationship between the mind and language.

NTL theory research at ICSI is focused on answering the following questions:

- 1) How can the brain support thought and language? How do the neural structures of the brain shape the nature of thought and language?
- 2) How are language and thought related to other neural systems, including perception, motor control, and social cognition?
- 3) What are the computational properties of neural systems?
- 4) What are the applications of neural computing?

The thesis projects of three ICSI students, Nancy Chang, Eva Mok, and John Bryant, attempt to answer parts of the first two questions. (see page 4 for details). Lisa Aziz-Zadeh, a former ICSI post doc now at University of Southern California, uses fMRI technology to track what physically happens in the brain while it processes language (see ICSI Gazette, Vol. 4 No. 1, September 2005 for more on Aziz-Zadeh's fMRI experiments). Her fMRI experiments provide physical evidence in support of NTL theories about the relationship between the neural structures in the brain and language.

NTL answers many questions about the brain and language, and through basic research in several disciplines such as computer science, linguistics, neurobiology, and cognitive studies, provides a basis for practical applications to natural language processing systems. While theoretical NTL research continues, a group of ICSI researchers, led by current AI group leader Professor Srinivas Narayanan, are developing some of these practical applications based on NTL.

Question answering technology is one such application. ARDA's AQUAINT program, which ICSI has been involved in since it started a few years ago, enters Phase III this fall. Narayanan and his team at ICSI will be working closely with colleagues at the University of Texas at Dallas during Phase III. The ICSI team, through all phases of AQUAINT, has made use of NTL principles, particularly event modeling, in the development of intelligent question answering technology for computers. Event modeling can improve question answering technology by providing an intelligent template that describes a situation or event, providing keywords and background information that the software can use to search for potential matches in a set of data. Deep inferencing techniques and corpus based techniques are used for deriving the conceptual semantics needed for question answering systems.

A related application of NTL is semantic extraction, the use of semantics to access information. Many of the same techniques used in question answering can be applied to semantic extraction. ICSI is working on two semantic extraction applications, one for CISCO and one for Ask (formerly known as Ask Jeeves). The model of actions, processes, and events developed within the NTL project provides a natural, distributed operational semantics that may be used for simulation, validation, verification, automated composition, and semantic extraction.

### in this issue:

page 2  
As I See It  
by Nelson Morgan, Director

page 3  
News Briefs

page 4  
Featured Researchers

page 9  
Visiting Scholars

page 10  
Publications



## as i see it by Nelson Morgan, Director

Something there is that doesn't love a wall,  
That sends the frozen-ground-swell under it,  
And spills the upper boulders in the sun,  
And makes gaps even two can pass abreast.

-- Robert Frost, from "Mending Wall"

This year, with Congressional elections coming, many of our Federal legislators have rediscovered that undocumented visitors are entering our country. Much of their discussion has been pretty negative, particularly in the House of Representatives, where the emphasis has been on prevention and punishment. There are issues there, to be sure, but it would be a very bad thing if this discussion fanned the flames of intolerance. (Although "intolerance" as a descriptor has its limitations too – "tolerating" someone isn't too far from disliking them). For 230 years the US has been receiving immigrants, and there's no way for any of us to know how many broke the rules for entry. And of course with the exception of the Native Americans among us, all of us are descended from immigrants.

An intolerant attitude towards immigrants, or even the perception that such an attitude exists, is detrimental to scientific and technological progress. For instance, researchers can delay or forego internships or sabbaticals in the US because of perceived (and often real) difficulties with the visa process. Even when the formal process goes smoothly, international colleagues can be more wary about close collaboration when they infer widespread xenophobia in our country. Our participation in offshore international scientific exchange (for instance, participation in largely European projects) can be further limited by such impressions.

A brief look around ICSI, or around the Berkeley campus, reveals people from all over the world working together effectively. Of course ICSI and UC Berkeley both work very hard to ensure that our visitors have the proper visas, etc., and I'm certainly not suggesting that the legal requirements be ignored. But when immigrants become scapegoats for our problems, our future is at risk. For it has always been the immigrants that have led the way; it is immigrants who have prevented stagnation, providing new life for our culture.

Three of my four grandparents were immigrants from Eastern Europe in the early part of the 20<sup>th</sup> century. Frankly, I have no idea if they arrived in full conformance with legal requirements of the time, and I expect that this is true for many of us whose ancestors arrived in that era or before. But they worked hard and did well, and had large families that I think contributed significantly to their society, as do nearly all immigrants.

ICSI is based on the idea that science in general (and computer science in particular) thrives on a perspective that ignores national and ethnic boundaries. In practice, in order to achieve this, we often make quite specific agreements with national entities, and of course we work closely with US Federal agencies to try to improve the scientific and educational base in our own country. But it is difficult to make progress without paying attention to what is currently going on elsewhere.

Intolerance towards the "others" reaches its extreme in warfare. What can we say about this? People around the world have legitimate grievances that should be aired, but they continue to express them in a way that requires the suspension of the recognition of our human commonality. Sitting here in comfortable Berkeley there is little we can do to change this worldview. I suppose that it is naïve to think that competing groups can resolve their differences with a tough foosball game or by a verbal debate followed by sharing beer and pizza, but somehow it still seems to me that bringing individuals together to work in common, for instance in science or music, could help.

So, amidst a turbulent world, and one that sometimes seems to have forgotten the virtues of the search for knowledge, sits ICSI. We're very small, but I think we're doing the right thing, or at least we're trying to. We work to keep the Internet free while making it more secure; we try to make human-machine interaction more natural so that the humans don't have to be like machines to use them; and we are starting to develop applications of computer science to problems in genomics and to the study of cellular machinery. These topics do not comprise all that is being done in the name of computer science, but what they do cover is important. And in each case, the work is being done by a combination of US- and foreign-born scientists, and with far-reaching collaborations in Europe and Asia.

In this issue, we are focusing on the efforts in the study and processing of natural language that is going on at ICSI. This has been a major concern here since ICSI's inception, and important milestones have been achieved. Of course we will also inform you about the latest batch of ICSI babies, which is a particular pleasure to acknowledge. I have no new grandchildren to report, but since I already have 9, this is not a problem.

# news briefs

## AUGUST 2006

ICSI ALUM **ERIC ALLMAN** was honored at the Telluride Tech Fest 2006. Allman, author of Sendmail, the world's first Internet mail program, was a researcher in ICSI's "Realization Group" (the predecessor to today's Speech Group) in the early 1990's. More information on the Tech Fest honorees is available on The Telluride Watch website, [WWW.TELLURIDEWATCH.COM](http://WWW.TELLURIDEWATCH.COM).

The XORP team announced the release of **XORP VERSION 1.3** on August 2nd. This version has several new features, including the ability to build on Linux Fedora Core5, DragonFly BSD-1.4, and FreeBSD-6.1, implementation of IGMPv3 and MLDv2, and numerous bug fixes. Download XORP 1.3 and read more details at [xorp.org](http://xorp.org).

The Internet was buzzing about **VIATTA, INC. AND ICSI'S XORP ROUTING TECHNOLOGY**, in August, after a press release was issued in late July by Vyatta, Inc. regarding the release of their Open Flexible Router (OFR), which utilizes XORP as its routing stack. Around the same time, the online technology journal Light Reading featured Vyatta as one of the top ten new startups.

## JULY 2006

Congratulations to **DANA WILSON-GREEN** in the ICSI Accounting department on the arrival of her daughter, Nina, on Thursday, July 27. Nina weighed 6 pounds 15 ounces and was 19 inches long at birth.

**AN IBM PRESS RELEASE** issued on July 13, 2006 quoted ICSI Internet security experts regarding statistics on financial damage that could be caused by a major Internet worm outbreak.

Just in time for the World Cup final match on July 9th, **THOMAS SCHMIDT**, a visiting researcher working on FrameNet, completed "**KICKTIONARY**", a semantically annotated dictionary of soccer terms in German, French, and English. To call it a dictionary, however, is a bit misleading. It's more like a multilingual guide to the game of soccer, which not only defines terms, but defines them relative to other soccer terms, gives sample sentences showing correct usage, and clearly illustrates the situations during a soccer match relating to each term. If you followed the World Cup this year, but were too embarrassed to admit to friends and colleagues that you actually don't know what a corner kick is, this tool could prove to be very useful.

Kicktionary clearly shows how beneficial semantic annotation, such as that used in ICSI's FrameNet project, can be. While a regular dictionary simply provides basic definitions, pronunciation, and part of speech information, a semantically annotated dictionary such as Schmidt's Kicktionary provides the context necessary to show the meaning of a word as it applies specifically to soccer. By providing what is known as frame semantic information, the Kicktionary allows a user to understand the nuances in meanings of words as they are used to describe soccer.

**PROFESSOR GEORGE LAKOFF**, of UC Berkeley and ICSI's Neural Theory of Language project, was featured in the July 2006 issue of Chronogram, a Hudson Valley, New York based magazine of "events and



*Thomas Schmidt, creator of "Kicktionary", a multi-lingual soccer dictionary incorporating semantic information*

ideas". He was interviewed for the magazine by Loma Tychostup about his theories about the use of linguistic frames in politics. Since publication of his book on this very topic, 'Don't Think of an Elephant' several years ago, Lakoff has been a favorite expert for the media whenever debates between conservative and progressive politicians have intensified. The interview covers the effectiveness (or sometimes ineffectiveness)

of various public figures' use of frames when discussing issues currently facing the United States, such as terrorism and global warming.

## JUNE 2006

June 26, 2006 marked the **20TH ANNIVERSARY OF ICSI'S INCORPORATION** as a California non-profit corporation.

**DR. ATANU GHOSH**, XORP project leader, was appointed to the advisory board of Vyatta, Inc. According to a press release issued by Vyatta on June 20, the advisory board is a "who's who" of networking and open-source experts. The XORP technology developed by Ghosh and his team at ICSI is an integral part of Vyatta's open source router platform. Regarding his nomination to the board, Ghosh said, "Vyatta has been a strong supporter of the XORP project, and I'm pleased to participate in Vyatta's open-source networking community."

*Continued on Page 6*

# icsi researchers: ntl then and now

**TERRY REGIER**, currently an Associate Professor of Psychology at University of Chicago, worked at ICSI as a graduate student, then a post doc, from 1990-1993. In recent years, he has been a frequent visitor to ICSI, collaborating with Paul Kay on color naming work. He has always been interested in the way languages “package” human experience differently via imposition of categorization schemes on reality. He is also interested in universals that apply to categorization. While working on the NTL project (then called Lzero) he focused on cross-linguistic variation in spatial terminology using a computational model that could learn spatial language. His model predicted several universals, which have since been proved through empirical research. Regier’s current work on color naming universals, though not directly NTL related, has a similar scope. He is still very interested in the relationship between language and thought, and has been investigating this relationship through research on color naming, spatial terms, and language and grammar acquisition. A recent collaboration with ICSI’s Paul Kay and UCB’s Richard Ivry and Aubrey Gilbert on how language might effect perception (with relation to color terminology) was published in PNAS and reviewed in Science.

**BEN BERGEN**, an Associate Professor of Linguistics at the University of Hawaii, worked at ICSI from 1997-2001, exploring embodied construction grammars and simulation semantics. During his time at ICSI, he was primarily developing these theories as part of NTL. Today,



ICSI Alum Terry Regier

he is focused on providing empirical evidence, through lab experiments, on what people simulate mentally during language processing, and on the linguistic cues that lead to specific aspects of that simulation.

Three UC Berkeley Computer Science Ph.D. students are conducting NTL research at ICSI as the foundation for their dissertations.

**NANCY CHANG**, who is in the final stages of writing her thesis, focuses on grammar acquisition in early childhood language learning. Her work is the subject of a chapter in “From Molecule to Metaphor” by Professor Jerry Feldman (MIT Press, 2006) (see page 5 for more information). When a child first learns to speak, they often use single word utterances, but at some point they learn how to put words together to express more complicated ideas. Nancy’s thesis looks at the process in which children learn the correct way to put words together to express themselves.

**EVA MOK** is also working on language acquisition in children. She is focused on how children learn languages which, unlike English, rely much more on context than actual linguistic information to convey meaning. One language that she has looked at fairly extensively is Mandarin Chinese, which typically drops subjects and objects of verbs, leaving the listener/reader to rely on contextual information, rather than lexical units (words) to discern the subject and/or object.

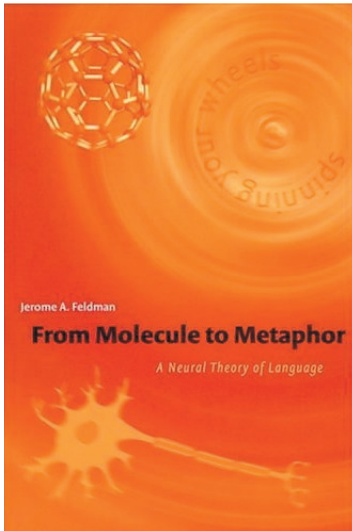
**JOHN BRYANT** is studying the way adults interpret complex sentences or ideas, using the principles of NTL. His work is based on the NTL principle that people combine words and context to come up with the “best fit” out of potential meanings for an utterance. This is known as “embodied construction grammar” and is a theory about grammar in which syntax and semantics are inseparable. ICSI’s FrameNet project uses this type of a grammar to form its basic unit of grammar for the FrameNet database of semantically annotated sentences.



ICSI Alum Ben Bergen



# from molecule to metaphor: a neural theory of language



The Neural Theory of Language project at ICSI celebrated a major milestone in June 2006 with the publication of Professor Jerome Feldman's book, "From Molecule to Metaphor: A Neural Theory of Language" (MIT Press).

Linguistics and philosophy, for both historical and technical

reasons, have been slow to integrate even the most basic neuroscience. Much of fundamental neuroscience is done with animals and, since only people use language, there is no easy way to extend animal findings to human thought and language. Over two decades, the interdisciplinary NTL group has shown how exploiting the neural embodied basis of language can yield scientific and practical advances. This book is the first systematic attempt to show how human language and thought arise as an extension of the physiology and experiences that people share with other animals. By integrating findings from all the cognitive sciences, Feldman is able to lay a foundation for an explicitly neural theory of language that is an integral part of contemporary science.

Professor Feldman draws from disciplines as varied as linguistics, neuro-physiology, and computer science to describe his theory. He hopes that the book will aid in the formation of a unified Cognitive Science. Early endorsements of the book suggest it may have a profound impact on the field. Professor V.S. Ramachandran of UCSD calls the book a "fascinating tour through the mysteries of the brain", Professor George Lakoff of UCB and ICSI says it is "an indispensable book for anyone interested in how human beings think, act, and communicate",

and Professor Steven Small of University of Chicago calls Feldman's perspective unique, and praises the book as exciting because it "shows why understanding the most complex computations of the human brain depends on taking account of the ontogeny and phylogeny of our species; and, by doing so, how it might be possible to build a truly embodied cognitive science".

The book is attracting attention outside the cognitive science community as well. Feldman was interviewed by Michael Krasny on the KQED Forum radio show on July 17th. Krasny conducted an in-depth interview with Feldman about the theories presented in the book, followed by nearly a half an hour of questions from the show's listeners. A transcription of the interview is available on the KQED Forum audio archives. ([WWW.KQED.ORG/EPARCHIVE](http://WWW.KQED.ORG/EPARCHIVE))

On August 22nd, Brad DeLong, (a UC Berkeley economics professor who is now well known as a blogger) posted a review of the book on his blog. He says that Feldman "is right when he claims ... that it is time to try to study human language seriously by starting with the observation that language is

"From Molecule to Metaphor is an indispensable book for anyone interested in how human beings think, act, and communicate."

--George Lakoff, University of California, Berkeley

produced and controlled by human brains active in the world". He relates his own experience of occasionally interchanging his new car and his old car in his speech and even in his thoughts to some of the theories presented in the book.

For more information, as well as updates and references for further reading, see the book web site: [WWW.M2MBOOK.ORG](http://WWW.M2MBOOK.ORG)

*Continued from Page 3*

ICSI researchers **MADELAINE PLAUCHÉ** AND **JOYOJEET PAL**, along with **DIVYA RAMACHANDRAN** AND **RICHARD CARLSON**, were awarded third prize in the CITRIS white paper competition for their proposed work on speech technology for developing regions. Plauché and Carlson had the opportunity to travel to India this spring to test their technology in Sempatti, Tamil Nadu, India. See page 8 for more information.



*Xavier Anguera of the Speech Group*

**JARON LANIER** was quoted in the New York Times business section on June 10. His recent article, "The Hazards of the New Online Collectivism", on Edge.org attracted attention from bloggers and online news sites for its criticism of Wikipedia. Dan Mitchell, a reporter for the Times, featured Lanier's article and reactions to it in a round-up of online news, called "So Many Airfares, So Much Data". (The article also talks about a new web service that predicts when low airfares will be available, and Adam Scott's blog of his experiences living off of "Monkey Chow" for a week.)

## **SPRING 2006**

**ICSI SPEECH** processing technology excelled in the 2006 National Institute of Standards and Technology (NIST) evaluations. The ICSI Speaker Diarization system and the ICSI/SRI Speech-to-Text (STT) system performed extremely well in all test conditions that were entered in the NIST evals. More information about this year's evals is available from the NIST 2006 Rich Transcription Eval Site. Although NIST regulations prevent comparing ICSI's results to those of other participating labs, complete results are available from the NIST web site.

ICSI's diarization technology was developed by **CHUCK WOOTERS**, **XAVIER ANGUERA**, AND **JOSE MANUEL PARDO**, and ICSI's STT team, along with a team from SRI International, included **ADAM JANIN**, **ANDREAS STOLCKE**, **XAVIER ANGUERA**, **CHUCK WOOTERS**, **KOFI BOAKYE**, **OZGUR CETIN**, AND **JOE FRANKEL**. This year's performance followed similarly strong showings for diarization and STT in 2004 and 2005.

In a letter to Nature magazine and Microsoft chairman Bill Gates, a group of senior female technology professors named ICSI's **SALLY J. FLOYD** as one of three women who exemplify "outstanding female experts in computing and other fields". Floyd was cited for her work on core Internet technologies. The letter was written to protest the lack of women in both Microsoft Research Cambridge's 2020 Science Group and a special issue of Nature on March 23, 2006. According to an article in The Age, an Australian newspaper, Microsoft has issued a statement saying that several women were invited to the workshop but were unable to attend.

# events at ICSI

## UPCOMING EVENTS THIS FALL

October 13th is an important day for ICSI this fall, with three events taking place.

First, ICSI's annual meeting of the Board of Trustees will be held in the morning. Following the closed Board Meeting, ICSI will host an open house beginning at 2:00 p.m. featuring research and technology demonstrations as well as two talks given by ICSI researchers Scott Shenker and Dilek Hakkani-Tür. At 4:00, we will host a reception and book party for Professor Jerome Feldman's book "From Molecule to Metaphor".

## SUMMER EVENT WRAP-UP

Summer at ICSI, in addition to being conference season and the time when we host many student interns, includes some social events where researchers can forget their conference and grant deadlines and just have fun for a little while.

This summer's events included an impromptu 20th birthday celebration of ICSI's incorporation as a California non-profit, our annual picnic in Tilden Park, an inhouse Foosball Tournament, and "ICSI at the Ballpark", an annual outing to the Oakland Coliseum for an A's baseball game. We were fortunate to have warm, sunny weather at both the picnic and the ball game, and the A's played an excellent game, hitting home runs and winning a decisive 7-2 victory over the Boston Red Sox.

The ICSI Foosball tournament was organized this year by Spanish visitor Alberto Amengual, who is working with the AI Group. Seven teams participated in the tournament, which consisted of three rounds of play with teams facing elimination at the end of each round. The final game, featuring Pedro Ruiz and Jacob Wolkenhauer versus Jeff Terrell and Sushant Rewaskar, took place during tea in mid-August. Ruiz and Wolkenhauer were victorious, and now hold the title of "ICSI Foosball Champions". It was the second tournament victory for Ruiz, and the first for Wolkenhauer.



*Pedro Ruiz, Jacob Wolkenhauer, Jeff Terrell, and Sushant Rewaskar compete in ICSI's Foosball Tournament*



*ICSI Staff and Visitors celebrate the 20th anniversary of ICSI's incorporation*

# speech research in tamil nadu, india

"I LIVE IN A VILLAGE SIX KILOMETERS FROM HERE IN THE HILLS. I CAME HERE [ARTHOOR] TO REGISTER MY BOY FOR SCHOOL NEXT YEAR. AFTERWARDS, I PLANNED TO GO TO DINDIGUL [ANOTHER TWENTY KILOMETERS AWAY] TO GET INFORMATION ON PLANT DISEASE AND TREATMENT. [...] MY BANANA CROPS AND ALL OF THE BANANA CROPS IN MY VILLAGE ARE AFFECTED BY A DISEASE. [...] NOW THAT I HAVE MET YOU AND USED THIS SYSTEM, I AM SATISFIED. I THINK THAT MY CROPS ARE AFFECTED WITH NEMATODES OR BORE WEEVILS. I WILL GO HOME NOW AND TRY THE RECOMMENDED TREATMENTS."

A banana farmer, who had never attended school but had taught himself to read, was one of several villagers to try a speech-driven dialog system built by ICSI researchers specifically for the needs and conditions of people living in developing regions like Tamil Nadu, India.

ICSI researchers Dr. Madelaine Plauché and Joyojeet Pal, along with Divya Ramachandran and Richard Carlson, were awarded third prize in the CITRIS white paper competition for their proposed work on Simple, Scalable Speech technologies to improve access to Information Technologies (IT) in developing regions. The project, supervised at ICSI by Dr. Chuck Wooters, is part of the UC Berkeley TIER (Technology and

"Now that I have used this system, I am satisfied."  
-a banana farmer in Tamil Nadu who tested ICSI's dialog system developed to aid local farmers

Infrastructure for Emerging Regions) project.

Last month in rural Tamil Nadu, where illiteracy rates range from 50% for men to 80% for women, a collaboration between the ICSI researchers and the staff of M.S. Swaminathan Research Foundation (MSSRF) in Sempatti resulted in the rapid creation and deployment of a low-cost, speech- and touch-screen driven application that enables villagers of all literacy levels to access existing written information.

Plauché, a linguist, and Carlson, a software developer, traveled to Tamil Nadu to meet with Udhaykumar Nallasamy, a computer science student at Amrita University in Coimbatore and local experts in agriculture, horticulture, and rural development at the MSSRF village resource center in Sempatti. After three weeks of collaborative design sessions, the team converted text from the MSSRF web site to a user-friendly interface that provides recommended agricultural practices, pest protection, and yields for local varieties of banana crops, in the form of pre-recorded Tamil and digital pictures. The Banana Crop interface is based on

automatic speech recognition (ASR) technology originally developed at ICSI, which was then customized based on the needs of local banana farmers in the Sempatti area.

The multi-modal application was quickly adopted by men and women of varying degrees of education and familiarity with technology. They either spoke single-word commands in Tamil (i.e. "pests" or "intercropping") or pressed buttons to navigate the visual user interface. The ASR technology accurately recognized speech input despite variations in dialect, environment, and background noise. Young children were especially adept at operating the system, and many people expressed great pride at hearing a computer speak in their dialect about content relevant to their day to day lives. Feedback from the villagers who used the system indicated a strong desire to have information on other crops and other topics in this form. In addition to relying on speech cues and easily recognizable images for ease of navigation, the application conveniently operates via either telephone or PC.

Speech technologies that offer easy access to relevant, up-to-date information are ideally suited for remote regions of the world and regions with high illiteracy rates. According to Dr. Plauché, "access to local, relevant information is extremely valuable for effective short-term and long-term decision making. By creating simple, easy-to-use speech tools, we hope to allow communities with a need for greater access [to this information] to make their own interactive applications."

With that goal in mind, Plauché, Carlson, and Udhaykumar are currently developing Open Sesame, an open source toolkit which will allow non expert speakers of any dialect to convert local language text into accessible, multi-modal applications using Text-to-Speech, Automatic Speech Recognition (ASR), and custom localization tools. The application is built with open-source software, rather than proprietary Windows software. The researchers believe open-source software is better suited to developing regions because it is free, and more importantly, easily customizable. MSSRF plans to install a version of the speech application in 100 community village centers throughout Tamil Nadu, Maharashtra, Andhra Pradesh, Rajasthan, and Orissa in the next three years. The new version will support three additional languages (Marathi, Hindi, and Oriya) and will greatly improve rural access to information on additional crops as well as topics such as animal husbandry, disaster preparedness, how to start a self-help group, local education and employment opportunities, and basic health and sanitation.

Photos:

[HTTP://WWW.ICSI.BERKELEY.EDU/NEWS/2006/SLIDESHOW.HTML](http://www.icsi.berkeley.edu/news/2006/slideshow.html)



# visiting scholars

*Since its inception, ICSI has had a strong international program consisting primarily of ties with specific countries. Current formal agreements exist with Finland, Germany, Spain, and Switzerland.*

## FROM FINLAND

Mathias Creutz (Speech)  
Jyri Kivinen (No Group)  
Teemu Koponen (Networking)  
Erno Lindfors (Algorithms)  
Pasi Sarolahti (Networking)

## FROM GERMANY

Gerald Friedland (Speech)  
Tobias Kiesling (Networking)  
Christian Kreibich (Networking)  
Birte Lönneker-Rodman (AI-FrameNet)  
Christian Müller (Speech)  
Thomas Schmidt (AI-FrameNet)  
Jan Scheffczyk (AI-FrameNet)  
Robin Sommer (Networking)  
Maximilian Teltzrow (No Group)

## FROM SPAIN

Alberto Amengual (AI)  
Xavier Anguera (Speech)  
Juan Botia (Algorithms)  
Lucia Conde (Algorithms)  
Acenscion Gallardo (Speech)  
Juan Montero (AI)  
Jose Manuel Pardo (Speech)  
Carmen Pelaez-Moreno (Speech)  
Pedro Ruiz (Networking)  
Alberto Suarez (Algorithms)  
Carlos Subirats (AI)  
Francisco Valverde (AI)

## FROM SWITZERLAND (IM2)

Sebastien Cuendet (Speech)  
Matthew Magimai-Doss (Speech)  
Matthias Zimmermann (Speech)

## AMI (EUROPEAN UNION)

Naresh Bansal (Speech)  
Joe Frankel (Speech)  
Jachym Kolar (Speech)

*In addition, we often have visitors associated with specific research and projects.*

## NETWORKING INTERNS

Mohit Chawla  
Lisa Fowler  
Jason Franklin  
Chris Grier  
Kaushik Lakshminarayanan  
Anirudh Ramachandran  
Sushant Rewaskar  
Jeff Terrell  
Atul Vasu  
Mythili Vutukuru

## NETWORKING VISITORS

Zhen Chen  
Alice Cheng  
Eric Friedman  
Zhichun Li  
Vijay Ramachandran  
Yun Shi  
Matthias Vallentin

## FRAMENET

Kyoko Ohara

## EXTREME ARCHITECTURE

Krste Asanovic  
Rose Liu  
Heidi Pan

## ALGORITHMS

Gad Kimmel  
Carlos Santos  
Sriram Sankararaman  
Srinath Sridhar

## SPEECH

Takahiro Shinozaki  
Can Berk Guder  
Reyyan Yeniterzi

## AI

Jaime Gomez-Ramirez



Matthias Vallentin



Lisa Fowler



Naresh Bansal

# publications listing

- M. ALLMAN, P. BARFORD, B. KRISHNAMURTY, AND J. WANG. Tracking the Role of Adversaries in Measuring Unwanted Traffic. Proceedings of Workshop on Steps to Reduce Unwanted Traffic in the Internet (SRUTI), July 2006.
- X. ANGUERA, M. AGUILO, C. WOOTERS, C. NADEU, AND J. HERNANDO. Hybrid Speech/Non-Speech Detector Applied to Speaker Diarization of Meetings. Speaker Odyssey 2006, San Juan de Puerto Rico, USA, June 2006.
- X. ANGUERA, C. WOOTERS, AND J. HERNANDO. Automatic Cluster Complexity and Quantity Selection: Towards Robust Speaker Diarization. Proceedings of MLMI 2006, Washington, USA, May 2006.
- X. ANGUERA, C. WOOTERS, AND J. HERNANDO. Purity Algorithms for Speaker Diarization of Meetings Data. Proceedings of ICASSP, Toulouse, France, May 2006.
- X. ANGUERA, C. WOOTERS, AND J. HERNANDO. Friends and Enemies: A Novel Initialization for Speaker Diarization. Proceedings of ICSLP-Interspeech 2006, Pittsburgh, PA.
- X. ANGUERA, C. WOOTERS, AND J. PARDO. Robust Speaker Diarization for Meetings: ICSI RT06s evaluation system. Proceedings of ICSLP-Interspeech 2006, Pittsburgh, PA.
- L. AZIZ-ZADEH, C. FIEBACH, S. NARAYANAN, J. FELDMAN, E. DODGE, AND R. IVRY. Modulation of the FFA and PPA while listening to sentences about faces and places. *NeuroImage*, July 2006.
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