

# A Thousand and one Applications





To implement the partnership, FAPESP and the company signed a collaboration agreement on December 15, 2006, valid for three years, which was extended in 2009 for another three years. This kind of partnership was unprecedented in Brazil, as it provided for joint basic research by universities and other scientific institutions in the state of São Paulo and a company the size of Microsoft, with the intermediation of FAPESP. “It’s a new model, because the company’s vision with respect to research is not utilitarian,” says Brito Cruz. “Microsoft does not expect that studies in partnership with universities will replace the research done in its own laboratories. The expectation is that the institute will advance knowledge with high-impact science, and train students well, so that Microsoft might eventually hire them in the future.”

The senior manager of research programs at Microsoft Research, Juliana Salles, adds that the company’s purpose is to work with academia and the scientific community, supporting innovation in projects that are relevant and will have an impact on mankind. “In particular, in the case of the Microsoft Research-FAPESP Institute, the goal is to foster collaboration that results in advancing the state of the art in computer science and scientific computing,” he explains. “Through FAPESP, we can work with the scientific community of the state of São Paulo on globally relevant issues, whose solutions involve innovations and advances in technology.”

#### INTERNATIONAL IMPACT

So far, the results of the partnership have achieved the objectives proposed by the institute. Among the main goals, Brito Cruz stresses quality scientific publications, with international impact. “Moreover, in each of the project areas, undergraduate, master’s and doctoral students have been trained,” he adds. Juliana summarizes the results: through December 2011, research funded by the research institute resulted in 44 articles published in scientific journals, 59 at international

## The goal is innovation in projects that are relevant and will have an impact on mankind

conferences and 54 at national meetings, in addition to 17 master’s theses and eight doctoral dissertations. Forty-one scholarships for doctoral, master’s and undergraduate students were granted.

One of the outstanding projects is *SinBiota 2.0 – BIOTA/FAPESP Program Information System: planning the next 10 years*, approved during the institute’s third public call, and begun on June 15, 2009. The project, coordinated by Professor Carlos Alfredo Joly, of the Institute of Biology of the State University of Campinas (Unicamp), has received R\$177,000 in funding, began in December of the same year and was completed in December 2011. The objective was to include new technologies, new interfaces and new user demands in the Sinbiota Environmental Information System for the Biota-FAPESP Program, enabling its evolution over the next ten years.

This FAPESP program, also known as the Virtual Biodiversity Institute, was founded in 1999 to systematize the

collection, classification and dissemination of information on biodiversity in the state of São Paulo. Joly adds that the Biota information system also began to be developed at that time. “In other words, it is outdated compared to more modern technologies,” he says. “In IT, ten years is an eternity.” Furthermore, the older system would not allow development of new, specific modules.

To overcome this limitation, the scientists developed a new modular information system using the most modern tools available. Now they can add socioeconomic data modules, for example, which allows them to better understand how biomas operate in areas close to cities. Sinbiota 2.0’s new computational tools will also enable new research in biology combining ecology, zoology, botany, genetics and biochemistry.

With it, researchers will be able to better understand living things in their environment and assess climate change impacts on biodiversity. “The modules allow us to export system data in order to forecast the impact of climate change or compare our information with that of gene banks such as GenBank, for example,” added Joly.

#### SMALL FARMS

Another project approved after Microsoft Research-FAPESP’s first call for proposals was *E-Farms: small farms connected to the world on a two-way street*.



The research was carried out between November 2007 and May 2010 under the leadership of Professor Claudia Bauzer Medeiros, at the Unicamp Institute of Computing. One of the two main goals was to capture and manage temperature and precipitation sensor data through a wireless network and develop software to use this data to monitor farms and manage crops.

The second goal was to develop low-cost solutions for wireless Internet access on small farms. “These goals were partially achieved,” says Medeiros. “A prototype was created to solve the connectivity and Internet issues, but nothing was implemented on the farms, as intended.” Temperature sensors were installed on the Unicamp campus, simulating a local network on a farm, and the data were transmitted wirelessly to a computer at the School of Agricultural Engineering, which relayed them to the Institute of Computing, where they were placed on the Internet.

The project was developed in partnership with the Guaxupé Coffee Growers Cooperative (Cooxupé), the world’s largest in the sector, with about 12,000 members in the states of São Paulo and Minas Gerais, who invested R\$50,000 in the initiative—about R\$ 200,000 more was provided by the institute. “One of our purposes, from the social point of view, was to create a low-cost data communications infrastructure to connect farms to the cooperative and, thus, allow them to access the Internet,” says Medeiros. “The ‘two-way street’ means that farmers receive information over the network, but also send new data to improve the analyses performed by the software.”

Although it has not achieved the full proposed technical objectives, the project had other relevant results. Among them are important scientific publications and the development of master’s and doctoral theses, as well as several software prototypes. “Additionally, there were two singular results that differentiate our study from many others in the area of computing,” says Medeiros. “Most important was training a new generation of researchers to work in multidisciplinary environments. This is the future of science, worldwide. This is the new era of what is being called *eScience*, in which computer scientists develop

research together with colleagues from other areas (in this case, agricultural sciences), so they can obtain relevant results, which would not be possible without this cooperation.”

She also cites a series of field experiments carried out with devices and real data, which showed the difficulties of working with networks of wireless sensors in rough terrain. “There are many projects in this area in Brazil, but using simulations or other types of technology,” she explains. “The results of our study serve to indicate directions and validate hypotheses.” But the story does not end there. Medeiros’ group continues working with Cooxupé, as numerous challenges in computer science applied to agriculture have been identified, and must be overcome. “For example, I have a doctoral student who is using new computational theories to process data from the cooperative’s weather stations in real time,” she says.

#### SUGARCANE BIOENERGY

The physicist and PhD in bioinformatics Ricardo Zorzetto Nicolliello Vencio, of the Ribeirão Preto School of Medicine of the University of São Paulo (USP), used computing for a different purpose. The objective of his project *Information technology applied to genomics for bioenergy: probabilistic identification using artificial intelligence*, approved after the institute’s third call for proposals, was

## New generations are learning to work in multidisciplinary environments

to develop software to try to determine the functions of sugarcane genes. With approximately R\$ 111,000 in funding, the study was carried out from February 2010 to January 2012.

Vencio recounts that the intention was to develop a computational system to assist biologists in assigning functions to sequenced genes whose roles are unknown. “This was achieved with a guided extrapolation of known information about ‘relatives’ of unknown genes using a mathematical model known as a Bayesian network,” he says. “We wanted to transform an existing very good and efficient proof-of-principle method into an application which can be used even by real biologists. It is in the final stages of preparation and is the object of the thesis of student Danillo Almeida e Silva.”

He played a key role in the project and explains what a Bayesian network—a known artificial intelligence technique—is: “Imagine any social network in which a given user has friends who have other friends and so on. Bayesian modeling is a social form of modeling in which people are the ‘nodes’ and the relationships between them are the interactions between these nodes. In our case, the nodes are genes and similarity relations and kinship among them are the interactions. With a Bayesian network set up, we can probabilistically infer the function of an unknown gene from the relationships it has with other genes whose functions are already known.”

With this technique the researchers extrapolate the information on genes with defined functions to others, whose roles are unknown, but which have the same evolutionary origin. But making it work is not simple. “From a technical standpoint, the challenges were greater than we expected,” said Vencio. “The existing mathematical method was very good, but the software, developed at the University of California, Berkeley, which is what users really need, was much worse than we thought. But this serves to emphasize the relevance of the study: if no one does what we’re doing,

no one will be able to take advantage of the state of the art to determine gene functions in practice.”

#### PREVENTING BLINDNESS

Jacques Wainer, professor at the Unicamp Institute of Computing, is also trying to develop a technology not yet seen in Brazil. Approved after the institute's second public call for proposals, his project *Automatic screening of diabetic retinopathies: Information technology in the fight against preventable blindness* seeks to develop software capable of detecting changes in fundus oculi images indicative of diabetic retinopathy, a disease caused by diabetes that can lead to blindness.

Developed in partnership with the Federal University of São Paulo (Unifesp), work began in late 2008 and ended in July 2011 with funding of about R\$300,000 from the institute. According to Wainer, about a thousand images of four hundred patients were analyzed. However, the results obtained still need to be improved. “We developed a technique for detecting anomalies which is unusual in medical image processing. It has certain advantages but also some disadvantages,” he explains. “The software we developed detects the anomalies most frequent in patients with diabetic retinopathy, but not yet all. And accuracy rates in detecting these anomalies are not yet comparable with the best results published in the literature.”

#### SOCIAL INCLUSION

The *E-citizenship: Systems and methods to establish a culture mediated by information and communication technologies* project seeks to develop the architecture and design of virtual social networks, which permit the inclusion of any citizen, even the illiterate or those with low literacy. “One of the great challenges of computing today is the search for methods and system designs that enable access for all and make sense primarily for those more disadvantaged when seeking knowledge,” says Maria Cecília Baranauskas, a professor at the Unicamp Institute of Computing and coordinator of the study.

According to Baranauskas, this challenge is unique because there are no experiments abroad to look to for inspira-

## A new social network facilitates access and participation by people with little schooling

tion. Baranauskas reminds us that the social networks available today were not designed to facilitate access by all segments of the population. “For us, design solutions for interactive systems and their interfaces should take into account the cultural context of the social group in question,” she explains. “For this reason, we decided to create an interface that allows people to look at the computer screen and know what to do, that permits them to understand and use the system to communicate and exchange information.”

Approved after the first call for proposals, the project received R\$228,000 in funding from the Microsoft Research-FAPESP Institute and was carried out between November 2007 and April 2010. One of its main achievements was the creation of an inclusive social network, which can be accessed through [www.vilanarede.org.br](http://www.vilanarede.org.br), with the active participation of ordinary people, including the digitally illiterate and people with low literacy. “It was jointly developed by the research group and partner communities, based in Vila União and

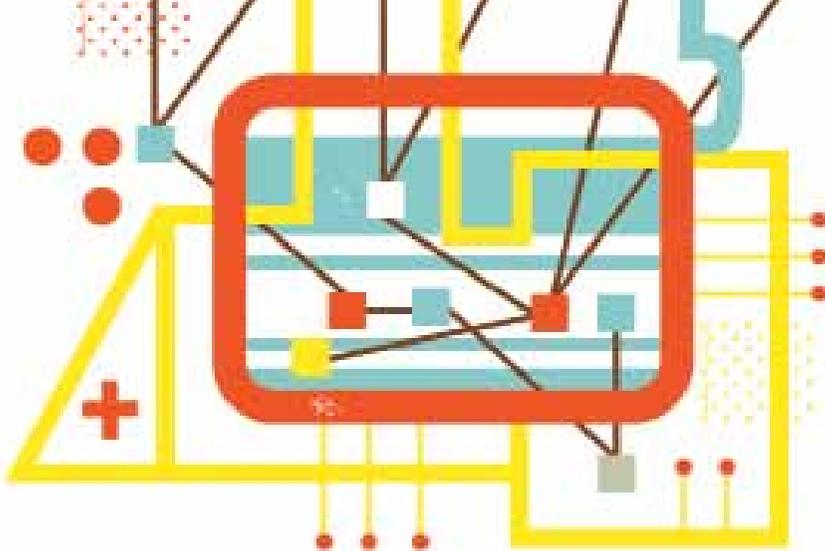
its surroundings in the city of Campinas,” says Baranauskas. The idea is that they will be able to share information easily as they exchange products, services and other activities.

After her experiences when leading this study, Baranauskas confirmed her belief that institutions like Microsoft Re-

search-FAPESP are of unquestionable importance in promoting science in Brazil. “Mainly because of insights obtained by looking at the projects from two perspectives,” she says, “one aligned to international research in the area of knowledge and the other situating the expected benefits and scientific advances in the context of Brazil and Brazilian society in which the problems are directly relevant.”

#### THE VALUE OF THE ABSTRACT METHOD

According to the physicist Richard Venicio, from USP's Ribeirão Preto campus, this institute is extremely important. “It fosters some areas that, if provided only with traditional financing, would receive no attention,” he says. “In general, academics tend to be satisfied with proof-of-principle. Entities such as Microsoft Research know the value of an abstract method transformed into a real tool that can be used by others. This synergy of visions, in our case, enabled funding of a study that, without this spirit, would perhaps have stayed in a drawer forever for lack of support.”



According to Brito Cruz, FAPESP's scientific director, with the creation of the institute, FAPESP has consolidated its business strategy—consisting of three pillars. The first pillar is support for the training of scientists and others in the state of São Paulo; the second, funding for basic research; and the third, a set of initiatives and research projects in which FAPESP seeks to associate research excellence with its application or at least the perspective of application within a short period. “The Microsoft Research-FAPESP Institute for Research in Information Technology is part of this strategy,” he says.

Harold Javid, Microsoft Research program director for the Americas, Australia and New Zealand, has said that the company's staff is proud of the partnerships with researchers from São Paulo. According to him, they resulted in new scientific knowledge in several areas. “For example, we have had institute projects about how the climate is affecting agriculture and crop produc-

tivity and how plants respond to that,” he explains. “The studies also show how technology can evolve to support scientists who face these challenges.”

According to Javid, Microsoft firmly believes that computers and software continue to significantly improve the lives of the world's people, creating new products that support industry and new opportunities for communication and dissemination of knowledge. Through the Microsoft Research-FAPESP Institute, the technology allows scientists to work on scenarios extremely relevant to mankind and advance their research in ways that would not be possible otherwise. “Researchers who are trying to understand climate change trends and their impact on society and the economy, for example, can be equipped with new instrumentation and new mechanisms to make sense of their data,” he explains. “Technology is a key to handling these complex scenarios and we're happy to participate in this process.” ■

## SCIENTIFIC ARTICLES

- MARIOTE, L. E. *et al.* TIDES a new descriptor for time series oscillation behavior. **Geoinformática**, v. 15, p. 75-109, 2011.
- FORTES, M. R. S. *et al.* Bovine gene polymorphisms related to fat deposition and meat tenderness. **Genetics and Molecular Biology**, v. 32, p. 75-82, 2009.
- CURI, R. A. *et al.* Associations between LEP, DGAT1 and FABP4 gene polymorphisms and carcass and meat traits in Nelore and crossbred beef cattle. **Livestock Science**, v. 135, p. 244-50, 2011.

## FROM OUR ARCHIVES

*Contact of the third degree*  
Issue No. 187 – September 2011

*Virtual convergence*  
Issue No. 172 – June 2010

*Knowledge and inclusion*  
Issue No. 154 – December 2008

*Digital inclusion*  
Issue No. 134 – April 2007

## Projects funded by the Microsoft Research-FAPESP Institute

PROJECT	LEADER	INVESTMENT
Navigating in space-time scales and mastery of knowledge – No. 2011/52070-7 (2012-2015)	Claudia Bauzer Medeiros IC/Unicamp	to be defined
Use of the systems biology approach to develop a model for plant functioning – No. 2011/52065-3 (2012-2016)	Marcos Silveira Buckeridge IB/USP	to be defined
Soil–vegetation–atmosphere interactions in a tropical landscape in transformation – No. 2011/52072-0 (2012-2015)	Rafael Silva Oliveira IB/Unicamp	to be defined
A culturally contextualized environment for natural and flexible interaction supporting the resocialization process for chronic patients in a hospital context – No. 2010/52135-9 (2011-2013)	Junia Coutinho Anacleto CCET/UFSCar	R\$ 102.265,30
E-Phenology: the use of new technologies to monitor phenology and climate change in the tropics – No. 2010/52113-5 (2011-2013)	Leonor P. Cerdeira Morellato IB/Unesp Rio Claro	R\$ 325.231,78
Environment monitoring and modeling of genetic potential in sugarcane cultivars in adequate hydric soil conditions – No. 2010/52139-4 (2011-2013)	Regina Célia de Matos Pires AC/SAASP	R\$ 237.285,37
Integration of data in systemic biology: characterization of biological phenomena based on structural and functional information – No. 2010/52138-8 (2011-2013)	Ronaldo Fumio Hashimoto IME/USP	R\$ 181.340,81
AgroDataMine: development of data mining methods and techniques to support climate change studies with emphasis on agrometeorology – No. 2009/53153-3 (2009-2012)	Agma Juci M. Traina ICMCSC/USP	R\$ 178.631,48
SinBIOTA 2.0 – Biota/FAPESP Program Information System: planning the next 10 years – No. 2009/53151-0 (2009-2011)	Carlos Alfredo Joly IB/Unicamp	R\$ 177.115,09
Development and application of a network of geosensors for environmental monitoring – No. 2009/53154-0 (2009-2012)	Celso Von Randow Inpe	R\$ 216.957,00
Information technology applied to bioenergy genomics: probabilistic identification using artificial intelligence – No. 2009/53161-6 (2010-2012)	Ricardo Nicolliello Vencio USP Ribeirão Preto	R\$ 111.392,75
JamSession: decentralized architecture for specialized virtual worlds and web 3.0 – No. 2008/53977-3 (2008-2011)	Flávio Soares Corrêa da Silva IME/USP	R\$ 35.686,65
Automatic screening of diabetic retinopathies: information technology in the fight against preventable blindness – No. 2008/54443-2 (2008-2011)	Jacques Wainer IC/Unicamp	R\$ 237.938,49
E-Farms: small farms connected to the world on a two-way street – No. 2007/54558-1 (2007-2010)	Claudia Bauzer Medeiros IC/Unicamp	R\$ 109.658,24
The Butterfly Project: an integrated mobile computing system for home health care – No. 2007/54479-4 (2007-2010)	Fabio Kon IME/USP	R\$ 107.705,22
X-Gov: application of the concept of media crossed with electronic public services – No. 2007/54488-3 (2007-2010)	Lucia Filgueiras Poli/USP	R\$ 42.959,67
E-Citizenship: systems and methods for creating a culture mediated by information and communication technologies – No. 2007/54564-1 (2007-2010)	Maria Cecília Baranauskas IC/Unicamp	R\$ 176.281,19
PorSimples: textual simplification of Portuguese for inclusion and digital accessibility – No. 2007/54565-8 (2007-2010)	Sandra Maria Aluisio USP São Carlos	R\$ 47.843,05