Alejandro Cornejo

Oblong Industries
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Interests Distributed Computing, Distributed Robotics, Fault-Tolerance, Mobile Wireless Networks.

Academics

Harvard University, Cambridge MA — 2012 – 2014
Postdoctoral Research Fellow.

Massachusetts Institute of Technology, Cambridge, MA — 2007 – 2012
PhD in Computer Science.

Institute of Applied Mathematics and Systems (UNAM Mexico) — 2005 – 2007
Master in Computer Science, with highest honors.

Instituto Tecnolgico de Mexico (ITAM Mexico) — 2001 – 2005
B. Eng. in Computer Engineering, with highest honors.
B. Eng. in Telematics Engineering, with highest honors.

Experience

Oblong Industries — *Software Engineer*
Mezzanine Team — October 2014 - present
Working on the main product team for Mezzanine, the core Oblong product, and the next generation tool for collaboration and infopresence. Currently driving the effort to change the architecture to allow mezzanine to be distributed across multiple machines in possibly disparate networks. The main challenge is to ensure the architecture scales across machines while maintaining state consistency and a responsive UI feedback at each machine. Programming language being used most prominently is C++ together with the g-speak platform.

Harvard University — *Postdoctoral Research Fellow*
Radhika Nagpal — September 2012 - September 2014
Designed and developed a micro embedded operating system for the Kilobot platform to facilitate the development of distributed algorithms. I also designed various distributed localization algorithms for swarms of simple robots with distance-only sensing with different trade-offs between communication and computation, and implemented said algorithms on the Kilobot platform. . Developed the programing environment `kilobotics.com` geared towards people starting out with swarm robotics. Studied bio-inspired task-allocation and designed an algorithm that shows it is possible to reach optimal task-allocation in sublinear time with only constant memory.

CSAIL (MIT) — *Research Assistant*
Nancy Lynch — September 2007 - October 2012
My PhD research focused on local distributed algorithms for dynamic wireless networks and multi-robot systems. Some of the problems I worked on include: maintaining connectivity (or k-connectivity) of a robot swarm while allowing each robot to perform tasks independently; reliable and efficient computation with beeps (maximal independent set, coloring, etc); environment characterization for robotic exploration; prioritized information dissemination in vehicular networks; distributed localization of networks of simple robots (using only bearing sensors); failure detectors in asynchronous systems; aggregation in dynamic networks.

Oracle — *Intern*
Mark Dilman — June 2011 - September 2011
Developed methodology and evaluation framework for workload management algorithms for the Oracle globally distributed database system. Designed various load balancing algorithms tailored for different configurations of the databased system, and identified database perfor-

mance metrics for optimal load balancing. This purpose of this work was to guide the design of new database load balancing algorithms for the Oracle platform.

Institute of Mathematics (UNAM) *Research Assistant*
Sergio Rajsbaum July 2006 - August 2007
Theoretical distributed computing. I defined an enriched version of the iterative immediate snapshot model augmented with failure detectors. I analyzed the limits of problem solvability under the traditional notion of failures and provided alternative failure definitions that allow the extended iterative snapshot model to be as powerful as the asynchronous shared memory model with failure detectors.

Microsoft Research *Intern*
Onur Mutlu January 2007 - April 2007
Designed and implemented an X86 performance multi-core simulator that includes pipeline details, out of order execution and a cache model that includes interconnection latencies and memory coherence. Implemented trace generation/reading tools to profile ordinary applications in the X86 performance simulation. This work was subsequently used as a platform for testing new memory architectures for the X86 platform.

Cannes Laboratory *Research Assistant*
Alfredo Weitzenfeld August 2003 - August 2004
Extended the NSL (Neural Simulation Language) system execution to a distributed master-slave computer network, the master displays results and dispatches simulation and training work to the slaves. The core simulation component of NSL can be executed on embedded systems and the results can be visualized offline or online by a computer.

Papalote Museo del Nino *Independent Contractor*
Children's Museum October 2003 - June 2005
Designed and implemented several interactive systems including the virtual tours (*Juega, Toca y Aprende* and *Nutricin*), which later became full expositions. Developed interactive 3D monkey character that imitates spectators, as well as the interactive educational game on nutrition (*Qu comes que adivinas?*).

Neuroimaging Laboratory *Research Assistant*
Mara Elena Algorri August 2002 - November 2005
Developed calibration and 3d tracking algorithms for stereoscopic vision. Implemented an image segmentation algorithm for localizing objects based on shape and color. An inverse kinematics system for animating virtual characters. Worked on a reconstruction algorithm to recover polygonal surfaces from medical studies (CAT, MRI, etc).

Publications

Michael Rubenstein, Alejandro Cornejo, Radhika Nagpal, *Programmable self-assembly in a thousand-robot swarm*, Science, 2014

Alejandro Cornejo and Radhika Nagpal, *Distributed Range-Based Relative Localization of Robot Swarms*, Workshop on Algorithmic Foundations of Robotics (WAFR 2014) 2014.

Alejandro Cornejo, Anna R. Dornhaus, Nancy A. Lynch, Radhika Nagpal, *Task Allocation in Ant Colonies*, International Symposium on Distributed Computing (DISC 2014), 2014

Alejandro Cornejo, Andrew J. Lynch, Elizabeth Fudge, Siegfried Bilstein, Majid Khabbazian and James McLurkin, *Scale-Free Coordinates for Multi-Robot Systems with Bearing-only Sensors*, International Journal on Robotics Research (IJRR 2013) 2013.

Alejandro Cornejo, Calvin C. Newport, Subha Gollakota, Jayanthi Rao, Thomas J. Giuli, *Prioritized gossip in vehicular networks*, Ad Hoc Networks 11(1): 397-409 (ADHOC 2013), 2013.

Yehuda Afek, Noga Alon, Ziv Bar-Joseph, Alejandro Cornejo, Bernhard Haeupler, Fabian Kuhn, *Beeping a maximal independent set*, Distributed Computing (DIST 2013), 2013.

Alejandro Cornejo and Andrew J. Lynch and Elizabeth Fudge and Siegfried Bilstein and Majid Khabbazian and James McLurkin, *Scale-Free Coordinates for Multi-Robot Systems with Bearing-only Sensors*, Workshop on Algorithmic Foundations of Robotics (WAFR 2012) 2012.

Alejandro Cornejo, Seth Gilbert and Calvin Newport, *Aggregation in Dynamic Networks*, Symposium on Principles of Distributed Computing (PODC 2012) 2012.

Alejandro Cornejo, Nancy Lynch and Srikanth Sastry, *Asynchronous Failure Detectors*, Symposium on Principles of Distributed Computing (PODC 2012) 2012.

Mikhail Volkov, Alejandro Cornejo, Nancy Lynch, Daniela Rus. Environment Characterization for Non-Recontaminating Frontier-Based Robotic Exploration , International Conference on Principles and Practice of Multi-Agent Systems (PRIMA 2011), November 2011 [**Best Student Paper Award**].

Yehuda Afek, Noga Alon, Ziv Bar-Joseph, Alejandro Cornejo, Bernhard Haeupler, Fabian Kuhn. Beeping a Maximal Independent Set , International Symposium on Distributed Computing (DISC 2011), 2011 [**Invited for Distributed Computing Journal**].

Alejandro Cornejo and Nancy Lynch, *Reliably Detecting Connectivity Using Local Graph Traits*, International Conference On Principles Of Distributed Systems (OPODIS 2010), Dececember 2010.

Alejandro Cornejo and Calvin Newport, *Prioritized Gossip in Vehicular Networks* , Foundations of Mobile Computing (DIALM-POMC 2010), 2010 [**Invited to Ad-Hoc Networks Journal**].

Alejandro Cornejo, Saira Viqar and Jennifer Welch. *Reliable Neighbor Discovery for Mobile Ad-Hoc Networks*, Foundations of Mobile Computing (DIALM-POMC 2010), 2010 [**Invited to Ad-Hoc Networks Journal**].

Alejandro Cornejo and Nancy Lynch, *Fault Tolerance Through k-Connectivity*, International Conference on Robotics and Automation: Workshop on Network Science and Systems Issues in Multi-Robot Autonomy (ICRA 2010), 2010.

Alejandro Cornejo and Fabian Kuhn, *Deploying Wireless Networks with Beeps*, International Symposium on Distributed Computing (DISC 2009), 2009.

Alejandro Cornejo, Nancy Lynch, Saira Viqar, Jennifer Welch, *A Neighbor Discovery Service Using an Abstract MAC Layer*, Allerton Conference (Allerton 2009), 2009.

Alejandro Cornejo and Nancy Lynch, *Minimum Spanning Trees and Cone-Based Topology Control*, Symposium on Principles of Distributed Computing (PODC 2009), 2009.

Alejandro Cornejo, Ruy Ley-Wild, Fabian Kuhn and Nancy Lynch, *Keeping Mobile Robot Swarms Connected*, International Symposium on Distributed Computing (DISC 2009), 2009.

Alejandro Cornejo and Nancy Lynch, *Connectivity Service for Mobile Ad-Hoc Networks*, Self-Adaptive and Self-Organizing Systems (SASO 08): Spatial Computing Workshop, 2008 [**Best Student Paper Award at CSW08**].

Alejandro Cornejo, Sergio Rajsbaum, Michel Raynal and Corentin Travers, *Failure Detectors are Schedulers*, Symposium on Principles of Distributed Computing (PODC 2007), 2007.

Ramiro A. Prez, Alejandro Cornejo and Mara Elena Algorri, *Construction of Camera-Based*

Frameless System: Technical Details and Clinical Applications, American Association of Neurological Surgeons (AANS 2006), 2006.

Alejandro Cornejo and Mara Elena Algorri, *Camera-Based 3D Motion Tracker for Interactive Computer Graphics Animation*, Research on Computing Science, 2004.

Alejandro Cornejo and Mara Elena Algorri, *Construction of a Frameless Camera-Based Stereotactic Neuronavigator*, International Conference of the IEEE Engineering in Medicine and Biology Society (IEMBC 2004), 2004.

Awards and Honors

- Alfonso Caso Award 2008, UNAM
- Akamai Presidential Graduate Fellowship 2007, MIT
- Institute of Mathematics Fellowship 2006, UNAM
- Alumni Association Research Award for Computer Engineering 2006, ITAM.
- CONACyT Fellowship 2004-2006 (National Council of Science and Technology of Mexico)
- Best Thesis of Computer Engineering and Information Technology 2005, ANIEI
- Award to Academic Excellence in Computer Engineering 2004, ITAM
- Best GPAs of Telematics Engineering 2004, ITAM
- Best GPAs of Computer Engineering 2004, ITAM
- Mention in the University Robotics Contest 2002, UIA
- 3rd place in Latin American ACM Programming Contest finals 2002