

Dr. Juan Cristóbal Zagal

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Cornell University

Mechanical & Aerospace Engineering (MAE)

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EDUCATION

Cornell University, Ithaca, USA

Sibley School of Mechanical and Aerospace Engineering

Postdoc – research in robotics, self-modeling 2008-

Center for Neurosciences, Valparaíso, Chile

Instituto de Sistemas Complejos de Valparaíso

Postdoc – research in robotics, embodied cognition 2007-2008

Universidad de Chile, Santiago, Chile

School of Physical and Mathematical Sciences

Ph.D. Engineering Sciences - Automation 2007

P.E. Electrical Engineering, *summa cum laude* 2000

Royal Institute of Technology, Stockholm, Sweden

Computational Vision and Active Perception Laboratory

M.Sc. Scientific Computing 2002

RESEARCH DISTINCTIONS

FONDECYT Postdoctoral Fellowship 2007-2009: Proposal Nr. 3080048 nationwide selected best engineering postdoctoral project.

RoboCup Engineering Challenge Award 2004: A best paper award, out of 118 papers, at the RoboCup¹ International Conference (two awards given per year), Lisbon, Portugal, 2004.

NHI Human Brain Mapping Award 2000: Travel award for the best (10%) student papers presented at HBM² conference, San Antonio, Texas, USA, 2000.

Travel Awards: Artificial Life XI (2008). RoboCup (2007, 2006, 2004, 2003) awarded by Robot Soccer International Federation. RoboCup American Open (2003) awarded by Carnegie Mellon University.

Universidad Chile Research Fellowship: Awarded by The School of Engineering at the University of Chile to pursue doctoral studies in robotics (2003, 2004).

STINT Fellow: Awarded by the Swedish Foundation for International Cooperation on Research and Higher Education (2001, 2002).

SFSR Research Fellow: Awarded by Swedish Foundation for Strategic Research for doing research in Medical Image Analysis at CVAP/CAS KTH (2000, 2001).

KTH Fellow: Awarded by the Swedish Royal Institute of Technology (1999, 2000).

¹Premier event in adaptive multi-agent systems. <http://www.robocup.org> → research / conferences.

²Premier international conference for functional imaging of the human brain.

APPOINTMENTS

Cornell University Mechanical & Aerospace Engineering (MAE) Ithaca, NY, USA. http://www.cornell.edu Postdoctoral Researcher – Advisor: Hod Lipson	09/08 -
Center for Neuroscience of Valparaíso (CNV) Instituto de Sistemas Complejos de Valparaíso (ISCV) Valparaíso, Chile. http://www.cnv.cl Postdoctoral Researcher – Advisor: A.G. Palacios	11/07 - 08/08
European Organisation for Astronomical Research (ESO) Very Large Telescope Interferometer (VLTI) Antofagasta - Santiago - Munich. http://www.eso.org Real Time Systems Specialist	04/04 - 07/07
Universidad de Chile Department of Electrical Engineering (DIE) Santiago, Chile. http://www.uchile.cl Lecturer - Doctoral Fellow – Advisor: J. Ruiz-del-Solar	03/03 - 12/06
Royal Institute of Technology (KTH)³ Computational Vision and Active Perception Laboratory (CVAP/CAS) Stockholm, Sweden. http://www.kth.se Researcher Engineer - Doctoral/MSc Fellow – Advisor: Tony Lindeberg	09/99 - 11/02

PUBLICATIONS

Articles in Journal or Book Chapters

- [1] J. C. Zagal, J. Delpiano, and J. Ruiz-del-Solar, “Self-modeling in humanoid soccer robots,” *Robotics and Autonomous Systems*, vol. 57, no. 8, pp. 819–827, 2009.
- [2] G. Herrera, J. C. Zagal, M. Diaz, M. J. Fernandez, A. Vielma, M. Cure, J. Martinez, F. Bozinovic, and A. G. Palacios, “Spectral sensitivities of photoreceptors and their role in colour discrimination in the green-backed firecrown hummingbird (*Sephanoides Sephaniodes*),” *Journal of Comparative Physiology A*, vol. 194, no. 9, pp. 785–794, 2008.
- [3] J. C. Zagal and J. Ruiz-del-Solar, “Combining simulation and reality in evolutionary robotics,” *Journal of Intelligent and Robotic Systems*, vol. 50, no. 1, pp. 19–39, 2007.
- [4] J. C. Zagal, I. Sarmiento, and J. Ruiz-del-Solar, “An application interface for UCHILSIM and the arrival of new challenges,” in *RoboCup 2005: Robot Soccer World Cup IX*, vol. 4020 of *Lecture Notes in Computer Science*, pp. 464–471, Springer, 2005.
- [5] J. C. Zagal and J. Ruiz-del-Solar, “UCHILSIM: A dynamically and visually realistic simulator for the robocup four legged league,” in *RoboCup 2004: Robot Soccer World Cup VII*, vol. 3276 of *Lecture Notes in Computer Science*, pp. 34–45, Springer, 2004. **Winner of a Best Paper Award in RoboCup International Symposium (out of 118 papers).**

³In collaboration with P.E. Roland Brain Research Group at Karolinska Institute.

- [6] J. C. Zagal and J. Ruiz-del-Solar, "Learning to kick the ball using Back-to-Reality," in *RoboCup 2004: Robot Soccer World Cup VII*, vol. 3276 of *Lecture Notes in Computer Science*, pp. 335–346, Springer, 2004.
- [7] J. C. Zagal, J. Ruiz-del-Solar, P. Guerrero, and R. Palma, "Evolving visual object recognition for legged robots," in *RoboCup 2003: Robot Soccer World Cup VI*, vol. 3020 of *Lecture Notes in Computer Science*, pp. 181–191, Springer, 2003.
- [8] J. Ruiz-del-Solar and J. C. Zagal, "How contests can foster the research activities on robotics in developing countries: Chile - a case study," in *RoboCup 2003: Robot Soccer World Cup VI*, vol. 3020 of *Lecture Notes in Computer Science*, pp. 748–756, Springer, 2003.
- [9] F. Hoffmann and J. C. Zagal, *Soft Computing and Industry - Recent Applications*, ch. Evolution of a Tactile Wall-Following Behavior in Real Time, pp. 747–756. Springer-Verlag, 2002.

Conference Proceedings

- [1] J. C. Zagal and H. Lipson, "Resilient behavior through controller self-diagnosis, adaptation and recovery," in *PerMIS'09: Performance Metrics for Intelligent Systems Workshop, National Institute of Standards and Technology, Gaithersburg, Maryland, USA.*, September 2009.
- [2] J. C. Zagal and H. Lipson, "Towards self-reflecting machines: Two-minds in one robot," in *ECAL 2009: Tenth European Conference on the Simulation and Synthesis of Living Systems, Budapest, Hungary*, 2009.
- [3] J. C. Zagal and H. Lipson, "Self-reflection in evolutionary robotics: Resilient adaptation with a minimum of physical exploration," in *GECCO 2009: Proceedings of the Genetic and Evolutionary Computation Conference, Late Breaking Papers, Montreal, Canada*, pp. 2179–2188, 2009.
- [4] J. C. Zagal, J. Ruiz-del-Solar, and A. G. Palacios, "Fitness based identification of a robot structure," in *Artificial Life XI: Proceedings of the Eleventh International Conference on the Simulation and Synthesis of Living Systems*, pp. 733–741, MIT Press, Cambridge, MA, 2008.
- [5] M. Scholler, - Several Authors -, and J. C. Zagal, "Recent progress at the very large telescope interferometer," in *Advances in Stellar Interferometry*, vol. 6268 of *Proceedings of SPIE*, The International Society for Optical Engineering, 2006.
- [6] J. Ruiz-del-Solar, P. Vallejos, P. Loncomilla, J. C. Zagal, C. Moran, and I. Sarmiento, "UChile1 2005 team description," in *RoboCup 2005: 9th Int. Workshop on RoboCup, Lecture Notes in Computer Science*, Springer, 2005.
- [7] J. C. Zagal, J. Ruiz-del-Solar, and P. Vallejos, "Back-to-Reality: Crossing the reality gap in evolutionary robotics," in *IAV 2004: Proceedings 5th IFAC Symposium on Intelligent Autonomous Vehicles*, Elsevier Science Publishers B.V., 2004.
- [8] J. Ruiz-del-Solar, J. C. Zagal, P. Vallejos, P. Montero, R. Lastra, C. Gortaris, and I. Sarmiento, "Uchile1 2004 team description," in *RoboCup 2004: 8th Int. Workshop on RoboCup, Lecture Notes in Computer Science*, Springer, 2004.

- [9] X. Olivares, J. Ruiz-del-Solar, and J. C. Zagal, "On-line learning of an object manipulation behavior for legged robots," in *LARS 2004: Proceedings of the first IEEE Latin American Robotics Symposium, Mexico*, pp. 22–27, October 2004.
- [10] J. Ruiz-del-Solar, J. C. Zagal, P. Guerrero, P. Vallejos, C. Middleton, and X. Olivares, "Uchile1 2003 team description," in *RoboCup 2003: 7th Int. Workshop on RoboCup, Lecture Notes in Computer Science*, Springer, 2003.
- [11] X. Olivares, J. C. Zagal, and J. Ruiz-del-Solar, "Learning to configure objects with legged robots," in *LCRA 2003: Proceedings of the First IEEE Latinamerican Conference on Robotics and Automation, Santiago, Chile*, pp. 51–58, November 2003.
- [12] J. Ruiz-del-Solar, J. C. Zagal, and R. Salazar, "Robot soccer and the robot soccer world cup RoboCup," in *LCRA 2003: Proceedings of the First IEEE Latinamerican Conference on Robotics and Automation, Santiago, Chile*, pp. 219–223, November 2003.
- [13] J. C. Zagal and J. Ruiz-del-Solar, "Supervised visual calibration for legged robots," in *LCRA 2003: Proceedings of the First IEEE Latinamerican Conference on Robotics and Automation, Santiago, Chile*, pp. 43–50, November 2003.
- [14] J. C. Zagal, E. Bjorkman, T. Lindeberg, and P. E. Roland, "Significance determination for the scale-space primal sketch by comparison of statistics of scale-space blob volumes computed from PET signals vs. residual noise," *Neuroimage*, vol. 11, May 2000. **Winner of NHI HBM Award.**
- [15] E. Bjorkman, J. C. Zagal, T. Lindeberg, and P. E. Roland, "Evaluation of design options for the scale-space primal sketch analysis of brain activation images," *Neuroimage*, vol. 11, May 2000.

Magazine Papers

- [1] H. Bonnet, B. Bauvir, A. Wallander, M. Cantzler, J. Carstens, F. Caruso, N. di Lieto, S. Guisard, P. Haguenaer, N. Housen, M. Mornhinweg, J.-L. Nicoud, A. Ramirez, J. Sahlmann, G. Vasisht, S. Wehner, and J.-C. Zagal, "Enabling fringe tracking at the vlti," *The Messenger*, vol. 126, pp. 37–40, Dec. 2006.
- [2] J. C. Zagal and J. Ruiz-del-Solar, "Aprendizaje de comportamientos reactivos complejos en robots cuadrúpedos," *Anales del Instituto de Ingenieros de Chile*, vol. 116, pp. 17–31, April 2004.
- [3] J. C. Zagal and J. Ruiz-del-Solar, "Adaptación evolutiva de un sistema visual de reconocimiento de objetos para el campeonato de fútbol robótico robocup," *Anales del Instituto de Ingenieros de Chile*, vol. 115, pp. 11–22, April 2003.

Theses

- [1] J. C. Zagal, *Embodied Robot Simulation*. PhD thesis, Universidad de Chile, 2007.
- [2] J. C. Zagal, "Evolutionary design of robotic behaviors," Master's thesis, Royal Institute of Technology, Stockholm, Sweden, 2002. TRITA-NA-E02063.
- [3] J. C. Zagal, "Evaluations and improvements on the scale-space primal sketch analysis of brain activation patterns," Master's thesis, Universidad de Chile - Royal Institute of Technology, 2000.

TALKS

GECCO 2009: Genetic and Evolutionary Computation Conference, July 2009, Montreal, Canada. Talk: *Self-Reflection in Evolutionary Robotics: Resilient Adaptation with a Minimum of Physical Exploration*.

ALife XI: The Eleventh International Conference on the Simulation and Synthesis of Living Systems, August 2008, Winchester, UK. Talk: *Fitness Based Identification of a Robot Structure*.

IAV 2004 The Fifth IFAC Symposium on Intelligent and Autonomous Vehicles, July 2004, Lisbon, Portugal. Talk: *Back to Reality: Crossing the Reality Gap in Evolutionary Robotics*.

RoboCup 2004 International Symposium, July, 2004, Lisbon, Portugal. Three talks: (1) *UCHILSIM: A Dynamically and Visually Realistic Simulator*, (2) *Learning to Kick the Ball Using Back to Reality* and (3) *UCHILSIM for RoboCup Special Interest Group*.

The Americas Spatial Camp, January, 2004, Ancud, Chile. Invited Speaker. Talk: *Space Robots, Today and the Future*.

Latinamerican Conference on Robotics and Automation, 24-26 November, 2003, Santiago, Chile. Three talks and a tutorial on Machine Learning.

Segundo Concurso Chileno de Robótica, 8-9 August, 2003, Universidad de Chile, Santiago, Chile. Main invited talk: *Robotic Soccer*.

RoboCup 2003 International Symposium, 10-12 July, 2003, Padova Fiere, Padova, Italy. Talk: *Evolving Visual Object Recognition for Legged Robots*.

Sixth On-line World Conference on Soft Computing in Industrial Applications (WSC6), September 10-24, 2001, Exposition: *Evolution of a Tactile Wall-Following Behavior in Real Time*.

Sixth Annual Meeting of the Organization For Human Brain Mapping, June 12-16, 2000, San Antonio, Texas, USA. Exposition: *Significance determination for the scale-space primal sketch by comparison of statistics of scale-space blob volumes computed from PET signals vs. residual noise*.

TEACHING

Universidad de Chile, School of Physical and Mathematical Sciences

Lecturer: co-taught *Mobile Robotics Course*, Dept. of Electrical Engineering. 2003

Co-supervisor of Master Thesis:

Pablo Guerrero: *Localización de un robot móvil usando información visual obtenida desde una cámara móvil*. 2003

Rodrigo Palma-Amestoy: *Navegación reactiva y generación de mapas de entorno usando SLAM*. 2003

Daniel Vicente Lühr: *Diseño y construcción de un sistema robótico móvil*. 2004

Pablo Montero: *Mejoras a un sistema de localización de robots móviles usando modelos de entorno*. 2005

Teaching Assistant for *Applied Mathematics Course*, Dept. of Mathematics. 1998

Teaching Assistant for *Electromagnetism Course*, Dept. of Physics. 1998

Pontificia Universidad Católica de Chile, School of Engineering

External examiner for a Ph.D. candidacy exam, Dept. of Computer Science. 2008

RESEARCH STATEMENT

I explore mechanisms that allow machines to learn more efficiently, to be more resilient and fault tolerant. I have been recently concentrated on the subjects of robotics self-modeling and self-reflection. In general I like to apply concepts from machine learning, mobile robotics, various control strategies, embodied cognitive science, computer vision and optics.

TECHNICAL SKILLS

RTOS Programming: VxWorks, certification from Wind River Systems, Alameda, California, April 2005. Proficient in C/C++, experienced with Java, familiar with Python and tcl/tk. Data analysis: Proficient with Matlab, experienced with Mathematica. Publishing: Experienced with \LaTeX . Other: Some basic experience with SolidWorks.

PRESS

Interviewed regarding robotics (specially about RoboCup and automated robotic inspection) in press, television and Internet news, being featured in Chilean media such as *El Mercurio*, *La Tercera*, *La Cuarta*, *Megavision*, *Chilevision*, *UCTV*, and international media such as *Univision*.

PROFESSIONAL ACTIVITIES

Member of the founding committee of the IEEE-RAS Latin American Robotics Council (2003).

Served as executive manager (2003-2005) for the IEEE-RAS Latin American Robotics Council, collaborating on the organization of robotic events in Latin America.

Member of the committee for organizing the First IEEE Latin American Robotics Contest (2003).

Member of the Organisation for Human Brain Mapping (2001-2002).

Member of the International Society for Optical Engineering (SPIE), since 2006.

Member of the International Society of Artificial Life (ISAL), since 2008.

Member of the Association of Computing Machinery (ACM), since 2009.

Reviewer for International Journals in Robotics (JINT, RAS).

REFERENCES

Frank Hoffman	Javier Ruiz del Solar	Roberto Tamai
Associate Professor	Associate Professor	Head of Engineering
Fac. Elect. and Computer Eng.	School Physics and Math. Sciences	LS - Paranal Observatory
Dortmund University	Universidad de Chile	European Southern Observatory
frank.hoffmann at tu-dortmund.de	jruizd at ing.uchile.cl	rtamai at eso.org

Hod Lipson	Adrian G. Palacios
Associate Professor	Visiting Professor INRIA and CREA Ecole Polytechnique
Mechanical & Aerospace Engineering	Associate Professor Universidad de Valparaiso
Cornell University	Centro de Neurociencia de Valparaiso
hod.lipson at cornell.edu	adrian.palacios at uv.cl