

## Zsolt Kira

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### CONTACT INFORMATION

Georgia Tech Research Institute  
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### RESEARCH INTERESTS

**Deep Learning for Perception,  
Perception and Multi-Modal Fusion for Robotics,  
Distributed Perception, Collaboration and Knowledge Sharing in Multi-Robot Teams,  
Human Control of Robot Swarms**

### EDUCATION

**Georgia Institute of Technology**, Atlanta, Georgia USA  
*College of Computing*

Ph.D., Computer Science, May 2010  
Advisor: Ronald C. Arkin  
Specialization: Intelligent Systems / Robotics  
Thesis Title: *Communication and Alignment of Grounded Symbolic Knowledge Among Heterogeneous Robots*

M.S., Computer Science, August 2008  
Specialization: Intelligent Systems / Robotics

**University of Miami**, Coral Gables, Florida USA  
*Department of Electrical and Computer Engineering*

B.S., Computer Engineering and Computer Science (Dual), July, 2002  
GPA: 3.92

### HONORS AND AWARDS

ATAS Outstanding Technical Achievement, Georgia Tech Research Institute, 2014.  
2014 Teaching Fellows Program Recipient, "Deep Learning for Perception", Spring 2015.  
Spot Award for Best Paper Presentation during Lab Day, SRI 2012 (with Raia Hadsell)  
AAMAS 2010 Won CoTeSys Best Robotics Paper Award  
AAMAS 2010 Nominated for Best Student Paper/Best Paper (only one to be nominated to 3 awards)  
FLAIRS 2009 Best Student Paper Award  
Awarded 2007 Google Summer of Code grant (8 proposals accepted out of 69 for the project)  
Outstanding SAIC Scholar Research Award (1st place), April 2007.  
2004 National Defense Science and Engineering Graduate Fellowship, Honorable Mention  
Eliahu I. and Joyce Jury Award for undergraduate scholarship  
Tzay Y. Young Award for Outstanding Senior Design Project  
Vice President of U.M. Chapter of ACM (Association for Computing Machinery)  
Member of the Eta Kappa Nu engineering honors society

### PEER-REVIEWED CONFERENCE PUBLICATIONS

- [C.16] **From Deep Learning to Episodic Memories: Creating Categories of Visual Experiences**, Doshi, J., Kira, Z., and Wagner, A.R., accepted to the Third Annual Conference on Advances in Cognitive Systems (ACS), 2015.
- [C.15] **An Evaluation of Features for Classifier Transfer during Target Handoff Across Aerial and Ground Robots**, Kira, Z., accepted to the IEEE International Conference on Robotics and Automation (ICRA), 2015.
- [C.14] **Mining Structure Fragments for Smart Bundle Adjustment**, Carlone, L., Alcantarilla, P., Chiu, H., Kira, Z., and Dellaert, F., Proceedings of the British Machine Vision Conference. BMVA Press, September 2014.
- [C.13] **Transfer of Sparse Coding Representations And Object Classifiers Across**

- Heterogeneous Robots**, Kira, Z., accepted to the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2014.
- [C.12] **Eliminating Conditionally Independent Sets in Factor Graphs: A Unifying Perspective based on Smart Factors**, Carlone, L., Kira, Z., Beall, C., Indelman, V., and Dellaert, F., accepted to the IEEE International Conference on Robotics and Automation (ICRA), 2014.
- [C.11] **Long-Range Pedestrian Detection using Stereo and a Cascade of Convolutional Network Classifiers**, Kira, Z., Hadsell, R., Salgian, G., and Samarasekera, S., accepted to the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2012.
- [C.10] **Unsupervised Topic Modeling for Leader Detection in Spoken Discourse**, Hadsell, R., Kira, Z., Wang, W., Precoda, K., accepted to the IEEE International Conference on Acoustics, Speech, and Signal Processing, 2012.
- [C.9] **Detecting Leadership and Cohesion in Spoken Interactions**, Wang, W., Precoda, K., Hadsell, R., Kira, Z., Richey, C., Jiva, G., accepted to the IEEE International Conference on Acoustics, Speech, and Signal Processing, 2012.
- [C.8] **Inter-Robot Transfer Learning for Perceptual Classification**, Kira, Z., in Proceedings of the 9th International Conference on Autonomous Agents and Multiagent Systems (AAMAS 2010), pp. 13–20. **(23.8% Acceptance Rate, Won CoTeSys Best Robotics Paper Award, Nominated for Best Student Paper/Best Paper)**
- [C.7] **Transferring Embodied Concepts between Perceptually Heterogeneous Robots**, Kira, Z., In Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 4650–4656, 2009.
- [C.6] **Mapping Grounded Object Properties across Perceptually Heterogeneous Embodiments**, Kira, Z., in Proceedings of the 22nd International FLAIRS Conference, pp. 57-62, 2009. **Won Best Student Paper Award.**
- [C.5] **Exerting Human Control Over Decentralized Robot Swarms**, Kira, Z. and Potter, M.A., in Proceedings of the International Conference on Autonomous Robots and Agents, pp. 566–571, 2009.
- [C.4] **Modeling Robot Differences by Leveraging a Physically Shared Context**, Kira, Z. and Long, K., in Proceedings of the Seventh International Conference on Epigenetic Robotics, pp. 53-59, 2007.
- [C.3] **Modeling Cross-Sensory and Sensorimotor Correlations to Detect and Localize Faults in Mobile Robots**, Kira, Z., in Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 1520-1526, 2007. San Diego, CA.
- [C.2] **Continuous and Embedded Learning for Multi-Agent Systems**, Kira, Z. and Schultz, A.C., in Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp.3184-3190, 2006.
- [C.1] **Forgetting Bad Behavior: Memory Management for Case-Based Navigation**, Kira, Z. and Arkin, R.C., in Proceedings of the IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), pp. 3145-3152, 2004.
- [W.4] **STAC: a new fusion model for complex scene characterization and semantic mapping**, Kira, Z., Wagner, A.R, Kennedy, C., Zutty, J., Tuell, G., accepted to the SPIE conference on Multisensor, Multisource Information Fusion: Architectures, Algorithms, and Applications, 2015.
- [W.3] **Multi-Sensor Fusion for Pedestrian Detection on the Move**, Kira, Z., Southall, B., Kuthirummal, S., and Eledath, J., accepted to the IEEE International Conference on Technologies for Practical Robot Applications (poster), 2012.

[W.2] **A Design Process for Robot Capabilities and Missions Applied to Microautonomous Platforms**, Kira, Z., Arkin, R.C., Collins, T., in SPIE Conference on Micro- and Nanotechnology Sensors, Systems, and Applications II, 2010.

[W.1] **Mission Specification and Control for Unmanned Aerial and Ground Vehicles for Indoor Target Discovery and Tracking**, Ulam, P., Kira, Z., Collins, T., Arkin, R.C., in SPIE Conference on Ground/Air Multi-Sensor Interoperability, Integration, and Networking for Persistent ISR, 2010.

NON-REFEREED

[U.2] **Deep Segments: Comparisons between Scenes and their Constituent Fragments using Deep Learning**, Doshi, J., Mason, C., Wagner, A., Kira, Z., Tech Report GT-CS-14-07, Georgia Tech, 2014.

[U.1] **Spatio-Temporal Case Based Reasoning for Efficient Reactive Robot Navigation**, Likhachev, M., Kaess, M., Kira, Z., and R.C. Arkin, 2005.

WORK  
EXPERIENCE

**Georgia Tech Research Institute**, Atlanta, Georgia, USA

**Research Scientist II**

**September, 2012 - June, 2015**

**Senior Research Scientist**

**July, 2015 - Present**

- Research in the areas of perception and deep learning for robotics, focusing on 1) deep learning for multi-modal fusion and robot perception, 2) efficient implementations of such algorithms, 3) distributed knowledge sharing in heterogeneous robot teams and 3) human-robot control of distributed swarms. Responsibilities include finding, assisting, and leading funding opportunities from various agencies such as DARPA, ONR, and NSF.

**Vision and Robotics, SRI International Sarnoff**, Princeton, New Jersey, USA

**Computer Scientist**

**May, 2010 - August, 2012**

- Research and development on perception for robotics. Led development of on-the-move pedestrian detection that combined several modalities. Included development of novel algorithms for LIDAR-based detection, and integration of stereo and IR-based detection algorithms into an end-to-end system capable of robust detections up to 25kph up to 50m. Collaborated on several computer vision and machine learning projects including deep learning for pedestrian detection, social construct detection from spoken dialogue transcripts and change detection. Led and assisted with several proposal responses to calls from DARPA, ONR, and NSF/NRI.

RESEARCH  
EXPERIENCE

**Mobile Robot Lab, Georgia Institute of Technology**, Atlanta, Georgia, USA

**Graduate Research Assistant**

**August, 2002 - Present**

- Research and development on numerous DARPA and privately funded projects, culminating in realized systems, several publications, and both indoor and outdoor real robot demonstrations. Some of the projects include:
  - **ARL Micro Autonomous Systems and Technology** (August, 2008 - Present)
    - Architectural design for complex, multi-task, multi-robot micro-vehicle missions.
    - Integration of robotic simulators and implementation of 3D robot navigation behaviors.
    - Implementation of behaviors for cooperative surveillance of an indoor environment by a team of ground and aerial autonomous vehicles [W.2].
  - **Fault Detection and Localization (funded by SAIC)** (May, 2006 - December, 2006)
    - Wrote a concept paper detailing novel methods for integrating cross-sensory and sensorimotor data on a mobile robot, leading to funding by Science Applications International Corporation.
    - Independently designed and implemented a framework for detecting and identifying faults occurring on a robot during performance of a task (resulted in publication [C.3]).
  - **Visual SLAM (funded by SAIC)** (August 2004 - December 2005)

- Conducted evaluation of vision-based Simultaneous Localization and Mapping (SLAM) in outdoor urban environments.
- Designed and implemented (co-work with Alan Wagner) an exploration algorithm designed to minimize uncertainty while using Visual SLAM.
- **DARPA Mobile Autonomous Robot Software** (January, 2003 - June, 2004)
  - Developed and evaluated forgetting mechanisms in a learning system.
  - Assisted with over one hundred outdoor robot trials evaluating the original case-based learning system.
  - Assisted with human usability study of robot mission specification software.
  - Resulted in a publication [C.1].

**Naval Research Laboratory**, Washington D.C. USA **June - August, 2004–2005, 2007-2009**  
**Contractor**, Supervisors: Alan C. Schultz, Mitchell A. Potter

- Investigated the use of Anytime Learning in a multi-agent resource protection domain, in which a simulator is used for online learning in an agent (using Genetic Algorithms).
- Developed algorithms to facilitate human control of a robotic swarm in a physicomimetic system.
- Resulted in publications [C.2] [C.5].

#### FUNDING

- “NRI: Large-Scale Collaborative Semantic Mapping using 3D Structure from Motion”, National Robotics Initiative (NSF), Award #1426998. Zsolt Kira (PI) and Frank Dellaert (Co-PI), \$392K over 2 years, 2015-2017.
- “A Framework for Sharing of Perceptual Features across UxV Systems for Collaborative Perception”, Naval Surface Warfare Center, Crane. Zsolt Kira (PI). \$20K over 1 year, 2013.
- Self-Organizing Maps and Growing Neural Gas, Google Summer of Code, \$5,000 over 3 months, 2012. Investigator: Zsolt Kira (PI)

#### INVITED TALKS

- **Invited Speaker at the Information Fusion and Cognitive Robotics session**, at the SPIE Defense and Security Symposium: Multisource, Multisensor Fusion Conference, Orlando, Florida, April, 2010. Also panelist at the panel discussion.
- **Invited Speaker at the Fifth International Cognitive Vision Workshop (ICVW09)**, at IROS 2009, St. Louis, Missouri, October, 2009. *Overcoming heterogeneity when transferring concepts between robots with different embodiments.*
- **Design Intelligence Laboratory**, Georgia Tech, Atlanta, GA, February, 2009. *Communication and Alignment of Grounded Symbolic Knowledge Among Heterogeneous Robots.*
- **Socially Intelligent Machine Lab**, Georgia Tech., Atlanta, GA. September, 2008. *Communication and Alignment of Grounded Symbolic Knowledge Among Heterogeneous Robots.*
- **Naval Research Laboratory**, Washington D.C. May, 2007. *Finding Common Ground: Knowledge Exchange among Heterogeneous Robots.*

#### TEACHING EXPERIENCE

**Georgia Institute of Technology**, Atlanta, Georgia USA **Jan, 2015 - Apr, 2015**  
**Deep Learning for Perception**

- Taught the first deep learning course at Georgia Tech. This is a graduate-level course with 47 students in it.

**Georgia Institute of Technology**, Atlanta, Georgia USA **August, 2007 - December, 2007**  
**Graduate Teaching Assistant**

- Courses:
  - “Robots and Society” (Spring, 2008). Instructor: Dr. Ronald C. Arkin
  - “Autonomous Robotics” (Spring, 2007). Instructor: Dr. Ronald C. Arkin
  - “Computing, Society, and Professionalism” (Fall, 2007). Instructor: Dr. Amy Bruckman
  - “Computing, Society, and Professionalism” (Spring, 2006). Instructor: Dr. Ashok Goel
- As teaching assistant, duties included giving lectures, creating assignments and exams, assisting with course materials, grading, and providing student assistance.

**University of Miami**, Coral Gables, Florida USA

*Teaching Assistant*

*Supervisor: Dr. Stephen Murrell*

**September, 2000 - August, 2001**

- Creation & grading of homeworks and tests for several courses including Introduction to Programming and Intermediate Programming.
- Duties also include system administration of a Unix system used by students and assisting students when they require help.

STUDENTS  
SUPERVISED

- Jonathan Suit, M.S. student, Deep Learning for Outdoor Urban Detection, summer of 2015.
  - Yen-Chang Hsu, ECE Ph.D. student, NRI: Large-Scale Collaborative Semantic Mapping using 3D Structure from Motion, 2015-present.
  - Kaushik Patnaik, M.S. student, NRI: Large-Scale Collaborative Semantic Mapping using 3D Structure from Motion, summer of 2015.
  - Shawn Rigdon, ECE Ph.D. student, Deep Learning on 3D Data, 2015-present.
  - Christopher Chow, M.S. student, Deep Learning for Outdoor Urban Detection, 2015-present.
  - Chris Beall, ECE Ph.D. student, NRI: Large-Scale Collaborative Semantic Mapping using 3D Structure from Motion, Jan-Aug, 2015.
  - Darryl Sale, ECE Ph.D. student, NRI: Large-Scale Collaborative Semantic Mapping using 3D Structure from Motion, 2014-2015.
  - Alex Bassett, High school student, Indoor LIDAR-based navigation, summer of 2014.
  - William Van Wagstaff, M.S., Computer Science, Deep learning for object recognition using a Kinect, GTRI, summer of 2013.
  - William Agnew, High school student, A robot-assisted evacuation scenario, summer of 2013.
  - Alyx Falis, High school student, A robot-assisted evacuation scenario, summer of 2013.
  - Stephen Camp Jr., B.S., Computer Science, Distinguishing Experts and Non-Expert Workers Using 3D Perception, GTRI, summers of 2012 and 2013.
  - Suriya Gunasekar, Ph.D. (UT Austin), Collaborative filtering, SRI International Sarnoff, 2012.
  - Stylianos Doudalis, Ph.D. (UC Irvine), Twitter analysis for emergency response, SRI International Sarnoff, 2012.
  - Sung Hyun Park, M.S., MAST project (Robotics), Georgia Tech, 2009-2010.
  - Kathryn Long, B.S., Robotics, Georgia Tech, 2012.
- Recipient of Outstanding SAIC Scholar Research Award, third place 2008 UROC Research Symposium Judges Award, and publication [C.4].**

INVITED LECTURES

- **Naval Surface Warfare (Crane) Distinguished Lecture Series, Crane, IN, May 2015.** *Feature Learning for Multi-Modal Fusion and Collaborative Perception.*
- **CS 7630 Autonomous Robotics, Georgia Tech., Atlanta, GA. October, 2014.** *Deep Learning in Robotics.*
- **CS 7630 Autonomous Robotics, Georgia Tech., Atlanta, GA. October, 2008.** *Sharing of Grounded Symbolic Knowledge Among Heterogeneous Robots.*
- **CS 7630 Autonomous Robotics, Georgia Tech., Atlanta, GA. March, 2008.** *Heterogeneous Perception and Knowledge Sharing.*
- **CS 7630 Autonomous Robotics, Georgia Tech., Atlanta, GA. February, 2007.** *Heterogeneous Perception and Knowledge Sharing.*

SERVICE ACTIVITIES

- Program Committee, AAAI Conference on Artificial Intelligence, Robotics Track, 2013.
- Chair: "Vision and 3D Data Processing II", IROS 2012.
- Co-Chair: "Vision and 3D Data Processing I", IROS 2012.
- Co-chair: "Learning Systems" session, IROS 2009.
- Academic Reviewer:
  - Robotics and Computer Integrated Manufacturing special issue, 2014.
  - Joint IEEE International Conference on Development and Learning on Epigenetic Robotics (ICDL-Epirob, 2014).

- IEEE Transactions on Robotics (TRO, 2013).
- IEEE International Conference on Robotics and Automation (ICRA, 2009, 2012, 2013, 2014, 2015).
- IEEE International Conference on Robotics and Automation (IROS, 2011, 2013, 2014, 2015).
- Journal of Autonomous Agents and Multi-Agent Systems (JAAMAS, 2012).
- European Conference on Computer Vision (ECCV, 2012).
- IEEE Conference on Computer Vision and Pattern Recognition (CVPR, 2012).
- Journal of Intelligent and Robotic Systems (2010, 2012, 2014).
- International Conference on Unmanned Aerial Vehicles (UAV, 2010).
- The Tower (Undergraduate Research Journal of Georgia Institute of Technology, 2007-2009).
- Robotics demonstration for students at Kennesaw Charter Science and Math Academy, Cobb County, GA (Oct. 2013).
- National Robotics Week demonstration (April 2013) and organizer for GTRI (April, 2014).
- Participated in Mentoring Undergraduate Researchers workshop (January 2007), Motivating Undergraduates in Research workshop (October 2008).
- Robotics demonstration for students at Dodgen Middle School, Cobb county, GA (Dec. 2006).
- FIRST Lego League (FLL) robotics competition, technical judge (January 2007,2009).
- Lab manager, Mobile Robot Laboratory (2008-2010).

#### SOFTWARE

**MissionLab** - Contributed to this robotics simulator and mission configuration system implementing the AuRA behavior-based architecture. Several of my contributions, including a teleoperation interface GUI and several robot behaviors, have been included in the main release. It is available at <http://www.cc.gatech.edu/ai/robot-lab/research/MissionLab/>

**Fast Artificial Neural Network (FANN) library** - I implemented the Self-organizing Maps and Growing Neural Gas algorithms to this open-source library as part of Google Summer of Code, 2007. It is available at <http://www.sourceforge.net/fann>.

#### SKILLS

**Robotics:** Currently working with ROS (OSRF) and OpenCV/VLFeat, extensive prior experience with USARSim, and Player/Stage, Gazebo, MissionLab robotic simulation environments.

**Operating Systems:** Windows XP/2k/Vista, Unix, Linux (Redhat, Fedora, Ubuntu)

**Languages:** Proficient in C, C++, Java, Matlab

**Libraries:** OpenCV, Weka, QT, wxWidgets, OpenGL, GLUT

**Tools and Utilities:** Microsoft Access & Visual Studio, Eclipse, Netbeans, LaTeX

#### MEMBERSHIPS

- Institute of Electrical and Electronics Engineers (IEEE)
- IEEE Robotics and Automation Society

#### PERSONAL

- Citizenship: United States
- Fluent in spoken Hungarian