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# EROL ŞAHİN

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## Research Interests

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Autonomous (Cognitive+Swarm+Evolutionary) robotics, cognitive systems, swarm intelligence, adaptive systems.

## Education

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| <b>Boston University,</b>   | Boston, MA, USA |
| ◊ Ph.D. in Cognitive and Neural Systems   | Jan 2000        |
| ◊ Dissertation title: " <i>Visual Object Localization for Mobile Robots</i> "   |                 |
| <b>Middle East Technical University (METU),</b>   | Ankara, Turkey  |
| ◊ M.Sc. in Computer Engineering   | Feb 1994        |
| ◊ Dissertation title: " <i>A New Higher-Order Binary-Input Neural Unit: Learning and Generalizing Effectively via Using Minimal Number of Monomials</i> " |                 |
| <b>Bilkent University,</b>  | Ankara, Turkey  |
| ◊ B.Sc. in Electrical and Electronics Engineering   | Jun 1991        |
| <b>İzmir Fen Lisesi,</b>  | İzmir, Turkey   |
| ◊ High school diploma   | Jun 1987        |

## Academic Activities

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- ◇ Serving as an Associate Editor for the Adaptive Behavior journal since 2008.
- ◇ Serving on the Editorial Board of the Swarm Intelligence journal since 2006.
- ◇ Co-Chair for Turk Robotbilim Konferansi (TORK'2016)
- ◇ Program Co-chair for ICDL/Epigenetic Robotics '2014.
- ◇ Program Co-chair for Epigenetic Robotics '2010.
- ◇ Technical Program Chair on Swarm Robotics for ANTS'2010.
- ◇ Area Chair on Multi-Robots track of AAMAS'09.
- ◇ Guest editor (with M. Dorigo, M. Birattari, G. Di Caro, R. Doursat, A. Engelbrecht, L. M. Gambardella, R. Gross, and T. Stutzle) of the *Swarm Intelligence* journal for the *ANTS 2010 Special Issue* published in 2011.
- ◇ Guest editor (with Alan F.T. Winfield) of the *Swarm Intelligence* journal for the *Swarm Robotics Special Issue* published in 2008.
- ◇ Guest editor (with Marco Dorigo) of the *Autonomous Robots* journal for the *Swarm Robotics Special Issue* published in 2004.
- ◇ Co-organized (with Siddhartha Srinivasa) a workshop titled *Robot Manipulation: What has been achieved and what remains to be done?* at IROS'2014, Chicago, USA.
- ◇ Co-organized (with W.M. Spears and A.F.T. Winfield) the *Second Swarm Robotics Workshop* held at the *SAB'2006 (From Animals to Animats)*, Rome, Italy . Proceedings of the workshop is published in *Lecture Notes in Computer Science Series of Springer*.
- ◇ Co-organized (with W.M. Spears) the *Swarm Robotics Workshop* to held at the *SAB'2004 (From Animals to Animats)*, LA, USA on July 17th, 2004. Proceedings of the workshop was published as a State-of-the-art Survey book in *Lecture Notes in Computer Science Series of Springer*.
- ◇ Reviewer both for project proposals submitted to and projects that are being supported by European Commission Framework Programs, Swiss National Foundation, Israel Science Foundation, and Turkish Scientific and Technological Council.
- ◇ Reviewer for ICRA'07,'08, '10,'12,'13, IJCAI'03,'07, IROS'08, '09, '10, '11, '12, '13, IS-CIS'03, TOK'06,'07,'08.
- ◇ Reviewed for journals: Adaptive Behavior, Autonomous Robots, Swarm Intelligence, IEEE Transactions on Systems, Man and Cybernetics B and C, IEEE Transactions on Evolutionary Computation, International Journal of Information Technology , ACM Transactions on Autonomous and Adaptive Systems, ACM Transactions on Autonomous and Adaptive Systems, ASME Journal of Dynamic Systems, Measurement and Control, The Computer Journal, Turkish Journal of Electrical Engineering and Computer Sciences.

## Projects

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- ◇ Swarm UAV Systems. In this project, funded by ASELSAN, we aim to develop coordination methods for indoor and outdoor quadrotor swarms. Project duration: September 2017- March 2019. Funding: 499,191 TL.
- ◇ CIRAK: Compliant Robotic Manipulator Support for Assembly Workers. This project is funded by TUBITAK within the multi-national Flag-ERA project ROBOCOM++. The project aims to develop technologies to allow the use of a compliant robotic arm to aid an assembly worker by handing (and taking away from) him the necessary parts and tools as needed. Project duration: June 2017-June 2020. Funding: 565,486 TL.
- ◇ Towards Better Robot Manipulation: Improvement through Interaction. This project (funded within FP7 Marie Curie International Outgoing Fellowship) is funding Dr. Sahin's 17 month visit at Carnegie Mellon University's Robotics Institute during which he is working in collaboration with Prof. Sidd Srinivasa (Personal Robotics Lab.) and Prof. Matt Mason (Manipulation Lab.) as well as a 12 month period at METU afterwards. The project is developing learning algorithms that can provide Improvement THroUgh Interaction to robot's existing manipulation competences. Project duration: March 2014- August 2016. Funding: 300,000 Euro.
- ◇ Multi-Quadcopter coordination. Funded by Turkish Air Industries. In this project, we developed a proof-of-concept system that demonstrated a group of three quadcopter platforms to fly autonomously (fly-by-click) in a desired formation. Despite the lack of experience on aerial platforms, we were able to demonstrate the system within only 6 months. Project duration: July 2011- February 2012. Funding: 20,000 Euro.
- ◇ Affordance-based concept formation and tool use in humanoid robots: Funded by TÜBİTAK (Turkish Scientific and Technical Council) as a 1001 project (No: 109E033). In this project, we use a 53 DOF iCub humanoid robot platform and its physics-based simulator to study 1) how concepts, such as nouns and verbs in language, can be created from affordances and how they can be used to communicate with humans, and (ii) how a humanoid robot can learn the affordances enabled to him by a set of tools, and can use them to achieve goals that are otherwise unreachable. Funding: 122,000 Euro. Duration: Sep 2009 - Sep 2012.
- ◇ Emergence of Communication in iCub through Sensorimotor and Social Interaction. This project proposal (Web: [http://eris.liralab.it/wiki/Emergence\\_of\\_Communication\\_in\\_iCub\\_through\\_Sensorimotor\\_and\\_Social\\_Interaction](http://eris.liralab.it/wiki/Emergence_of_Communication_in_iCub_through_Sensorimotor_and_Social_Interaction)) submitted to the *Open Call* (Web: [http://eris.liralab.it/wiki/RobotCub\\_Open\\_Call](http://eris.liralab.it/wiki/RobotCub_Open_Call)) announced by the Robotcub (Web: <http://www.robotcub.org>) adlı project (funded within FP6 as an Integrated Project) was ranked 6th among 31 proposals and I was awarded (Evaluation report: [http://eris.liralab.it/wiki/images/a/a5/OpenCall\\_report.pdf](http://eris.liralab.it/wiki/images/a/a5/OpenCall_report.pdf) ) a 53 DOF iCub humanoid robot platform (costing 255,000 Euro ). The robot, one of the most complex humanoid robot platforms available, is designed to be open and is adopted by more than 20 laboratories (located in 8 different countries mostly within EU) worldwide. More information about the robot platform is available at: <http://icub.org>

- ◇ ROSSI (Emergence of communication in RObots through Sensorimotor and Social Interaction): A StREP project funded in FP7 within the “Cognitive Systems, Interaction, Robotics” call of ICT. Within ROSSI, METU used the experimental results obtained from behavioral and brain imaging experiments on both affordances and language to develop computational models that allowed the iCub humanoid robot to develop concepts represented by verbs and nouns in the language and to recognize humans’ actions in real-time. Funding (METU share): 433,000 Euro. Duration: Mar 2008 - Mar 2011, Web: <http://rossiproject.eu>.
- ◇ MACS (Multi-sensory Autonomous Cognitive Systems Interacting with Dynamic Environments for Perceiving and Learning Affordances) Project: A StREP project funded by the EC in FP6 within the “Cognitive Systems” strategic objective call of IST. Within this project, we investigated how the concept of affordances, which was originally conceived in Psychology, can be used in autonomous robot control. We developed a formalization of this concept towards using it at different levels of robot control ranging from perceptual learning to planning and, developed and implemented a robot control architecture. Funding (METU share): 307,000 Euro. Duration: Sep 2004 - Jan 2008, Web: <http://macs-eu.org>.
- ◇ Controllable Robotic Swarms (Project no: 104E066): A Career project awarded by TÜBİTAK. The main scientific objective of the project is to investigate how and to what extend the dynamics of a robotic swarm can be externally controlled. Towards this end, we have successfully designed, developed and manufactured 20 CD-sized mobile robots specifically for conducting swarm robotics research. Using these robots, we achieved the first truly self-organized flocking in robot swarms and have shown that the direction of the flock can be steered externally by controlling only a subset of the flock. Funding: 82,000 Euro. Duration: Apr 2005 - Apr 2010.
- ◇ EUCOG II (2nd European Network for the Advancement of Artificial Cognitive Systems, Interaction and Robotics), Network of Excellence Project, FP7-ICT-EUCogII-23128, Member, Member No: 1089, Feb 2009 - Jan 2012.
- ◇ EURON II (European Robotics Network), Network of Excellence Project, FP6-507728, Member, Member No: 137, METU representative (The first Turkish member of the network) , Sep 2003-Apr 2008.
- ◇ Sub-contractor for the SWARM-BOTS Project (Sep 2003 – Oct 2004): Participated as a *sub-contractor* for IRIDIA within the Swarm-bots project (described in detail later). Within this project, together with three students, developed PES (Parallelized Evolution System) as a platform that parallelizes the fitness evaluations of evolutionary methods over multiple computers connected via a network. METU budget: 8,000 Euro
- ◇ Workpackage Leader for Embedded Systems for Autonomous Robotics within the METU-ISTEC project (an Specific Support Action type project funded by TÜBİTAK). Workpackage budget: 15,000 Euro.
- ◇ Third-party for the SEE-GRID2 project through TÜBİTAK ULAKBİM. Within this project we developed an application for parallel execution of artificial evolution methods on GRID systems with Dr. Cevat Sener. Third party budget: 70,000 Euro

## Experience

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**Robotics Institute, Carnegie Mellon University,** Pittsburgh, PA, USA.  
*Visiting Researcher and Marie Curie International Outgoing Fellow* Aug 2013 - Aug 2015

- ◇ My stay is funded through my sabbatical as well as through a 30 month Marie Curie International Outgoing Fellowship funded within the FP7. Specifically, I worked towards developing learning algorithms that can provide Improvement THroUgh Interaction to robot's existing manipulation competences.

**Dept. of Computer Engineering, METU,** Ankara, Turkey  
*Associate Professor* Jan 2013 - present  
*Assistant Professor* Nov 2002 - Dec 2012

- ◇ Heading the KOVAN research lab. (Web: <http://kovan.ceng.metu.edu.tr> ) to study biologically inspired autonomous systems. The laboratory was officially by Dr. Sahin in 2004, and have received more than 2,000,000 Euro of funding from National and European Commission projects. At the moment, the laboratory host four faculty members and 15 graduate students and operating in 240  $m^2$  of space.
- ◇ Proposed and taught CENG585 (Fundamentals of Autonomous Robotics). Other courses taught: CENG569 (Neurocomputing), CENG232 (Logic Design), and CENG331 (Computer Organization), CENG334 (Introduction to Operating Systems).
  - CENG334 course was ranked **1st in student evaluation among the courses of the Faculty of Engineering**, and 4th within the University in 2010.
- ◇ Thesis conducted:
  - Celikkanat, H. "A Grounded And Contextualized Web Of Concepts On A Humanoid Robot", Ph.D. thesis, Middle East Technical University, 2011. Co-advisor.
  - Ugur, Emre, "A Developmental Framework for Learning Affordances", Ph.D. thesis, Middle East Technical University, 2011.
  - Yuruten, Onur. "Formation Of Adjective, Noun And Verb Concepts Through Affordances", M.Sc. thesis, Middle East Technical University, 2012. Co-advisor.
  - Tunaoglu, Doruk. "Implementation of a Closed-loop Action generation system on a humanoid robot through learning by demonstration", M.Sc. thesis, Middle East Technical University, 2010.
  - Dag, Nilgun, "Emergence of verb and object concepts through learning affordances", M.Sc. thesis, Middle East Technical University, 2010.
  - Atil, Ilkay, "Function and Appearance-Based Emergence of Object Concepts through Affordances, M.Sc. thesis, Middle East Technical University, 2010.
  - Akgun, Baris, "Action Recognition through Action Generation", M.Sc. thesis, Middle East Technical University, 2010.
  - Turgut Ali E., "Self-organized Flocking with a Mobile Robot Swarm", Ph.D. thesis(co-advisor), Middle East Technical University, 2008.

◇ Thesis conducted (cont.):

- Çelikkanat, Hande, "Control of a Mobile Robot Swarm via Informed Robots", M.Sc. thesis, Middle East Technical University, 2008.
- Gökçe, Fatih, "To Flock or not to Flock: Pros and Cons of Flocking in Long-range "migration" of Mobile Robot Swarms", M.Sc. thesis, Middle East Technical University, 2008. Fatih is continuing to work towards his Ph.D. with me.
- Doğar, Mehmet R., "Evolving Using Learned Affordances for Robotic Behavior Development", M.Sc. thesis, Middle East Technical University, 2007.
- Cakmak, Maya, "Robot Planning based on Learned Affordances", M.Sc. thesis, Middle East Technical University, 2007.
- Uğur, Emre, "Direct Perception of Traversability Affordance on Range Images through Learning on a Mobile Robot", M.Sc. thesis, Middle East Technical University, 2006.
- Eren, Selda, "Towards Learning Affordances: Detection of Relevant Features ve Characteristics for Reachability", M.Sc. thesis, Middle East Technical University, 2006.
- Soysal, Onur, "A Systematic Study of Probabilistic Aggregation Strategies in Swarm Robotic Systems", M.Sc. thesis, Middle East Technical University, 2005.
- Bahceci, Erkin, "Evolving Aggregation Behaviors for Swarm Robotic Systems", M.Sc. thesis, Middle East Technical University, 2005.

**Robotics Institute, Carnegie Mellon University,**  
*Visiting Researcher*

Pittsburgh, PA, USA.  
Jul - Sep 2003

- ◇ Reviewed pattern formation and adaptation in multi-robot systems. Evaluated the Buffon's needle method as a "blind area measurement" method for mobile robots to measure closed spaces that are beyond their immediate sensing range.

**IRIDIA, Université Libre de Bruxelles,**  
*Post-doctoral researcher - Swarm-Bots Project*

Brussels, Belgium  
Oct 2001 - Nov 2002

- ◇ The Swarm-Bots project was funded under the Open scheme of the FET (Future Emerging Technologies) part of the IST (Information Society Technologies) Programme of FP5 (Fifth Framework) to design and implement self-organizing and self-assembling robots based on swarm intelligence ideas. IRIDIA acted as the Coordinator for the project consortium, and I was responsible for developing both the concept of the swarm-bot robotics platform as well as the coordination tasks and algorithms for the robots.

**Boston University Neurobotics Lab.,**  
*Research Assistant*

Boston, MA, USA  
Sep 1996 - Jan 2000

**Neurotec Inc. (Now Artificial Life),**  
*System Administrator and Webmaster*

Boston, MA, USA  
Jan 1997 - Aug 1997

- ◇ System and network administration of the IT structure of the company.

**Dept. of Computer Engineering, METU,**  
*Research/Teaching Assistant*

Ankara, Turkey  
Sep 1991 - Jan 1995

## Publications

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81. Erol Sahin, Kutluk Bilge Arikan, Abdurrahman Hacıoglu, Nazm Kemal re, Mehmet Aslan, Ali Emre Turgut, Alper Erdener, (2017) “*Yeni Bir Savunma Konsepti olarak Sr ?HA Sistemleri,*” TOK 2017, Bildiriler Kitabı 709-713.
79. Dilibal Savas, Sahin Erol, Sahin Haydar, Kalkan Sinan, Sariel Sanem (editorler), *TORK (Turkiye 8. Robotbilim Konferansi) 2016 Bildiriler Kitabı*, 2017.
78. Celikkanat, H., Orhan, G., Pugeault, N., Guerin, F., Sahin, E., and Kalkan, S. (2016), “*Learning Context on a Humanoid Robot using Incremental Latent Dirichlet Allocation,*” **IEEE Transactions on Cognitive and Developmental Systems**, 8(1), 42-59.
77. Gokce, F., Ucoluk, G., Sahin, E., and Kalkan, S. (2015). “*Vision-Based Detection and Distance Estimation of MicroUnmanned Aerial Vehicles,*” **Sensors** 2015, 15(9), 23805-23846;
76. Ugur, E., Nagai, Y., Sahin, E., and Oztop, E. (2015) “*Staged Development of Robot Skills: Behavior Formation, Affordance Learning and Imitation with Motionese,*” **IEEE Trans. on Autonomous Mental Development**, June 2015, 119-139
75. H. Celikkanat, G. Orhan, N. Pugeault, F. Guerin, E. Sahin and S. Kalkan, “*Insansi Robotlarda Baglamin Ogrenilmesi*”, 1inci Turkiye Otonom Robotlar Konferansi (TORK), ODTU, 6-7 Kasim 2014.
74. F. Gokce, S. Olgunsoylu, G. Ucoluk, E. Sahin and S. Kalkan, “*Goruntu Isleme ile Mikro Insansiz Hava Araclarinin Algilanmasi*”, 1’inci Turkiye Otonom Robotlar Konferansi (TORK), ODTU, 6-7 Kasim 2014.
73. H. Celikkanat, G. Orhan, N. Pugeault, F. Guerin, E. Sahin and S. Kalkan, “*Learning and Using Context on a Humanoid Robot Using Latent Dirichlet Allocation*”, Int. Conference on Development and Learning and Epigenetic Robotics (ICDL-Epirob), 2014.
72. H. Celikkanat, E. Sahin, S. Kalkan, “*Recurrent Slow Feature Analysis for Developing Object Permanence in Robots*”, IROS Workshop on Neuroscience and Robotics, Tokyo, Japan, November, 2013
71. S. Kalkan, N. Dag, O. Yuruten, A. M. Borghi, E. Sahin, “*Verb Concepts from Affordances*”, **Interaction Studies Journal**, 15(1):1-37, 2014.
70. O. Yuruten, E. Sahin, S. Kalkan, “*The Learning of Adjectives and Nouns from Affordance and Appearance Features*”, **Adaptive Behavior journal**, 21(6):437-451, 2013.
69. E. Ugur, E. Oztop, E. Sahin (2012) *Self-discovery of motor primitives and learning grasp affordance*, Proc. IROS’2012, pp. 3260 - 3267 IEEE Xplore.
68. O. Yuruten, K.F. Uyanik, Y. Caliskan, A.K. Bozcuoglu, E. Sahin and S. Kalkan (2012) *Learning Adjectives and Nouns from Affordances on the iCub Humanoid Robot*, Proc. of From Animals to Animats 12. Lecture Notes in Computer Science, Volume 7426, Springer, (2012), pp: 330-340,.
67. F. Anelli, R. Nicoletti, S. Kalkan, E. Sahin and A. M. Borghi (2012) *Human and robotics hands grasping danger*, Proc. International Joint Conference on Neural Networks (IJCNN’2012).
66. M. Parlaktuna, D. Tunaoglu, E. Ugur, E. Sahin (2012) *Closed-loop primitives: A method to generate and recognize reaching actions from demonstration*, Proc. IEEE International Conference on Robotics and Automation (ICRA’2012).
65. M. Dorigo, M. Birattari, G. Di Caro, R. Doursat, A. Engelbrecht, L. M. Gambardella, R. Gross, E. Sahin and T. Stutzle(2011), *ANTS 2010 Special Issue – Editorial. Swarm Intelligence journal*, vol.5, 3-4, pp.143-147.
64. E. Ugur, H. Celikkanat, E., Sahin, Y. Nagai, E. Oztop (2011), *Learning to Grasp with Parental Scaffolding*, Proc. of HUMANOIDS’2011, 480-486, IEEE Xplore.

63. Bozcuoglu, A.K., Sahin (2011), *Traversability on a simple humanoid: What did I just trip over?*, Proc. of HUMANOIDS'2011, 701-706, IEEE Xplore.
62. Ugur, E., Sahin, E. Oztop (2011) . *Goal emulation and planning in perceptual space using learned affordances*. **Robotics and Autonomous Systems journal**. vol 59, issues 7-8, july-august 2011, pp 580-595
61. Ugur, E., E. Oztop, E. Sahin (2011) *Unsupervised Learning of Object Affordances for Planning in a Mobile Manipulation Platform*, In Proc. of IEEE Intl. Conf. on Robotics and Automation (ICRA'11), pp. 4312-4317.
60. Ugur, E., E. Oztop, E. Sahin (2011) *Going beyond the perception of affordances: Learning how to actualize them through behavioral parameters*, In Proc. of IEEE Intl. Conf. on Robotics and Automation (ICRA'11), pp. 4768 - 4773..
59. Dorigo, M.; Birattari, M.; Di Caro, G.A.; Doursat, R.; Engelbrecht, A.P.; Floreano, D.; Gambardella, L.M.; Gro, R.; Sahin, E.; Sttzle, Th.; Sayama, H.( (Editors) (2010) *Swarm Intelligence, 7th International Conference, ANTS 2010, Brussels, Belgium, September 8-10*. 6234, Lecture Notes in Computer Science, Berlin Heidelberg, Springer.
58. Johansson, B., Sahin, E. and Balkenius, C. (Editors) (2010) *Proc. of the Tenth International Conference on Epigenetic Robotics: Modeling Cognitive Development in Robotic Systems*. Lund University Cognitive Studies, 149. Lund: LUCS.
57. Akgun, B., Tunaoglu, D., E. Sahin (2010) *Action Recognition Through an Action Generation Mechanism*, Proc. of the Tenth International Conference on Epigenetic Robotics: Modeling Cognitive Development in Robotic Systems. Lund University Cognitive Studies, 149. Lund: LUCS, pp. 3-10
56. Atil, I., N. Dag, S. Kalkan, E. Sahin (2010) *Affordances and Emergence of Concepts*, Proc. of the Tenth International Conference on Epigenetic Robotics: Modeling Cognitive Development in Robotic Systems. Lund University Cognitive Studies, 149. Lund: LUCS, pp. 11-18 .
55. Uğur E., and Şahin, E. (2010) *Traversability: A Case Study for Learning and Perceiving Affordances in Robots*. **Adaptive Behavior journal**, June 2010 vol. 18 no. 3-4 258-284, SAGE Pub.
54. Çelikkanat H., and Şahin, E. (2010) *Steering Self-organized Robot Flocks through Externally Guided Individuals*. **Neural Computing and Applications journal**, Volume 19, Number 6, 849-865, Springer.
53. Gokce, F., and Şahin, E. (2010) *The pros and cons of self-organized flocking in the movement of mobile robot swarms*. **Theoretical Computer Science journal**, vol 411, 2140-2154, Elsevier.
52. Dag. N., I. Atil, S. Kalkan, E. Sahin (2010) *Learning Affordances for Categorizing Objects and Their Properties*, Int. Conference on Pattern Recognition, pages, 3089 - 3092, IEEE Xplore.
51. Uğur E., and Oztop E. and Şahin, E. (2009) *Learning affordance relations in a mobile robot with limited manipulation capabilities* . **Neuroscience Research journal**, vol. 65, pp. S183-S183, Elsevier.
50. Uğur E., and Oztop E. and Şahin, E. (2009) *Affordance learning from range data for multi-step planning*. Proc. of the Ninth Intl. Conference on Epigenetic Robotics (EpiRob'09), Lund University Cognitive Studies, vol 146, pp. 177-184 .
49. Şahin, E. and Erdogan S.T. (2009) *Towards linking affordances with mirror/canonical neurons*. Proc. of the 24th Intl. Symposium on Computer and Information Sciences (IS-CIS'09), IEEE Xplore, pp. 395-404.



48. Uğur E., and Oztop E. and Şahin, E. (2009) *Unsupervised Learning of Affordance Relations on a Humanoid Robot*. Proc. of the 24th Intl. Symposium on Computer and Information Sciences (ISCIS'09), IEEE Xplore, pp. 415-419.
47. Akgun, B. and Dag, N. and Bilal, T. and Atil, I. and Şahin, E. (2009) *Predicting future object states using learned affordances*. Proc. of the 24th Intl. Symposium on Computer and Information Sciences (ISCIS'09), IEEE Xplore, pp. 254-259.
46. Gökçe F. and Şahin, E., (2009) *To flock or not to flock: Pros and cons of flocking in long-range "migration" of mobile robot swarms*. In Proc. of the Eighth Intl. Conf. on Autonomous Agents and Multiagent Systems (AAMAS'09), pp. 65-72.
45. Bayındır L. and Şahin, E., (2009) *Modeling Self-Organized Aggregation in Swarm Robotic Systems*. Proc. of the IEEE Swarm Intelligence Symposium (SIS'09), IEEE Xplore, pp. 88-95.
44. Çelikkanat H., Turgut A.E., and Şahin, E. (2009) *Control of a Mobile Robot via Informed Robots*. In Proc. of the 9th Intl. Symposium on Distributed Autonomous Robotic Systems (DARS'08), Springer, pp. 215-225.
43. Rome, E., Paletta, L., Şahin, E., Dorffner, G., Hertzberg, J., Breithaupt, R., Fritz, G., Irran, J., Kintzler, F., Loerken, C., May, S. ve Uğur, E. (2008) *The MACS project: An approach to affordance-based robot control*. In: Towards Affordance-based Robot Control, Proc. of Dagstuhl Seminar 06231, Springer-Verlag, LNAI 4760, E. Rome, J. Hertzberg, and G. Dorffner (eds.), pp. 173-210, February 2008.
42. Şahin E., Girgin S., Bayındır L. and Turgut A.E. (2008) *Swarm Robotics*, In Swarm Intelligence - Introduction and Applications (editors: C. Blum and D. Merkle), Springer, pp. 87-100, 2008.
41. Turgut A.E., Huepe, C, Çelikkanat H., Gökçe, F. and Şahin, E. (2008) *Modelling Phase Transition in Self-Organized Mobile Robot Flocks*. In Proc. of the 6th Intl. Conf. on Ant Colony Optimization and Swarm Intelligence (ANTS'08). Lecture Notes in Computer Science, Springer, vol 5217, pages 108-119, 2008.
40. Şahin, E. and Winfield A.F.T. (2008) . *Special Issue on Swarm Robotics*. **Swarm Intelligence journal**, vol 2, no: 2-4.
39. Turgut A.E., Çelikkanat H., Gökçe, F. and Şahin, E. (2008) . *Self-Organized Flocking in Mobile Robot Swarms*. **Swarm Intelligence journal**, vol 2, no:2-4, pp. 97-120.
38. Doğar M.R., Uğur, E., Şahin E., Çakmak, M., (2008) *Using Learned Affordances for Robotic Behavior Development*, In Proc. of IEEE Intl. Conf. on Robotics and Automation (ICRA'08), pp. 3802-3807, 2008.
37. Turgut A.E., Çelikkanat H., Gökçe, F. and Şahin, E. (2008) . *Self-Organized Flocking with a Mobile Robot Swarm*. In Proc. of the 7th Intl. Conf. on Autonomous Agents and MultiAgent Systems (AAMAS'08), Padgham, Parkes, Muller and Parsons (eds.), pp. 39-46, 2008.
36. Şahin E., Çakmak, M., Doğar M.R., Uğur, E. and Üçoluk, G. (2007) *To afford or not to afford: A new formalization of affordances towards affordance-based robot control*. **Adaptive Behavior journal**, vol. 15, pp 447-472.
35. Çakmak M., Doğar M. R., Uğur E. and Şahin E. (2007), *Affordances as a Framework for Robot Control*. Proc. of the Intl. Workshop on Epigenetic Robotics (EpiRob).
34. Doğar M. R., Çakmak M., Uğur E. and Şahin E. (2007), *From Primitive Behaviors to Goal-Directed Behavior Using Affordances*. Proc. of the 2007 IEEE/RSJ Intl. Conf. on Intelligent Robots and Systems (IROS'07).

33. Uğur, E., Doğar M.R., Çakmak, M., Şahin E., (2007), *Curiosity-driven Learning of Traversability Affordance on a Mobile Robot*. Proc. of the IEEE Intl. Conf. on Development and Learning (ICDL'07).
32. Uğur, E., Doğar M.R., Çakmak, M., Şahin E., (2007) *The learning and use of traversability affordance using range images on a mobile robot*, Proc. of IEEE Intl. Conf. on Robotics and Automation (ICRA'07), pp 1721–1726.
31. Şahin E., Spears W. and Winfield A.F.T.(editors) (2007), **Proc. of the Second Swarm Robotics Workshop**, Lecture Notes in Computer Science, vol 4433, Berlin Heidelberg, Springer.
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1. Güler, M. and Şahin E. (1994). *A New Higher-Order Binary-Input Neural Unit: Learning and Generalizing Effectively via Using Minimal Number of Monomials*, Third Turkish Symposium on Artificial Intelligence and Neural Networks Proc., 51-60. Middle East Technical University, Ankara, Turkey.

## Invited Talks

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- ◇ *Grounding and Representing Verbs, Nouns and Adjectives using Affordances* at Invited talk at University of Plymouth, Plymouth, UK, Nov. 16, 2012.
- ◇ *Affordances and Concepts* at the Third Workshop on Human Behavior Understanding at IROS 2012. Villamoura, Portugal. October 7, 2012.
- ◇ *Towards robots that can shake and talk* at the Symposium on Reading Intentions: From children to robots. Pufendorf Institute for advanced studies, Lund, Sweden. March 5-6, 2012.
- ◇ *Affordances in the land of autonomous robotics* at International Workshop on Vision, Action and Language, Embodiment, Cefalu, Italy, April 19, 2011,
- ◇ *Affordances: The adventures of an elephant in the land of autonomous robots* at HUMANOIDS Workshop on Object-Action Complexes: Representations for Grounding Perception by Action and Grounding of Language by Interaction, Paris, France, December 7, 2009.
- ◇ *Swarm robotics and Cognitive robotics research* at KOVAN Research Lab, Sabanci University, December 16, 2009,
- ◇ *Self-organized flocking of mobile robots*, Lisbon Workshop on New Challenges for Cooperative Robotics, Lisbon, Portugal, Oct 24-26, 2008

## **Honors and Awards**

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- ◇ *mediaCenter GmbH*, Germany, fellowship (Aug 1996-Dec 1997)
- ◇ TÜBİTAK NATO A-1 Ph.D. fellowship (Jan 1995 - Jan 1996)
- ◇ *Bilkent University* fellowship (covering full tuition and a monthly stipend) (Sep 1987 - Jun 1991)
- ◇ *Hacı Ömer Sabancı Foundation* scholarship (Jan 1988 - Jun 1991)
- ◇ *İş Bank* Award (1987)
- ◇ Ranked 56<sup>th</sup> among 600,000 participants in the ÖYS (Turkish National University Entrance Exam) (1987)
- ◇ Ranked in top 0.1% among 40,000 qualified participants in the “Science High School” Entrance Examination of Turkey (1983)

## **Languages**

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- ◇ Fluent in all aspects of Turkish (native) and English.

## **Personal**

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- ◇ Citizenship: Turkish
- ◇ Birth: June 9, 1970, Turkey