Tarek El-Gaaly

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Profile

Expertise and hands-on experience in Computer Vision, Machine Learning and Robotics. More than 5 years of industry experience as a Software Engineer and Researcher. Extensive problem-solving skills and multidisciplinary work.

Education

Ph.D. in Computer Science, Rutgers University, USA 2009 – May 2015 expected
Research Specialization: Computer Vision and Machine Learning
Advisor: Ahmed Elgammal

M.Sc. in Computer Science, American University in Cairo, 2006 – 2010
Thesis: *Measuring Atmospheric Scattering from Digital Image Sequences*
Advisor: Joshua Gluckman
Thesis document: www.arxiv.org/abs/1407.3540

B.Sc. in Computer Science and Minor in Electronics, American University in Cairo, 2001 - 2005
GPA: 3.54 (*Cum Laude*)
Thesis: *Fine tuning the Linux kernel to achieve better performance for use on personal digital Assistants (PDAs)*
Source Forge Documentation: www.sourceforge.net/projects/pdtux

Selected Research and Projects

- **2015: Deep Architectures for Shape Analysis and Object Recognition**
  An investigation into using deep architectures (e.g. Stacked Autoencoders and Deep Belief Networks) for building 3D shape priors.
- **2014-2015: In-depth Manifold Analysis of Convolutional Neural Networks**
  An in-depth analysis of object-view manifolds within the layers of Convolutional Neural Networks. A new CNN model has been proposed based on the in-depth analysis. In submission.
- **2014: Perceptual 3D Object Recognition**
  Probabilistic approach to object-part decomposition of 3D point clouds with grounds in human perception. Published in AAAI 2015 (~26% acceptance).
- **2014: Joint Object Recognition – Categorization and Pose Estimation**
  RGBD object recognition using Homeomorphic Manifold Analysis to recognize objects and pose from multi-view images. Published in AAAI 2013 (~29% acceptance).
- **2013-2014: Autonomous Micro-aerial Vehicle (MAV) Localization using Satellite Maps**
  Used semantic features, such as buildings, in a Geometric Hashing framework to localize MAV views onto satellite maps. Published in ICPR 2014. In addition I have been working on vision for MAV platforms – the progress of this can be found here: https://bitbucket.org/tsenlet/robotts/wiki/Home
- **2013: NASA Centennial Challenge – Sample Return Robot**
  Member of WPI/Rutgers team. Worked on object recognition, tree/fence/hill detection, localization and design of stereo camera rigs.
- **2013: Object Feature Localization using Label Propagation over a Spatially and Visually Consistent Space**
  Built a novel approach to classify image feature points (object and object-part localization). Published in ICPR 2014.
- **2012: Multi-Modal Object Recognition**
  Category, instance and pose recognition using visual and depth fusion (RGB+D) using an Xbox Kinect. Achieved better than state-of-the-art results. This work was also used to build a near real-time object recognition system (video demo: youtu.be/IzaWJTiGmww).
- **2012: Autonomous Obstacle Avoidance of Multiple Robotic Airboats using an Android Smartphone**
  Used optical flow, trajectory clustering and reflection detection for reactive obstacle avoidance of autonomous airboats. Conducted at the Robotics Institute at Carnegie Mellon University (video demo: youtu.be/sVeYu3NA8KM).
- **2010 M.Sc. Thesis: Measuring Atmospheric Scattering from Digital Image Sequences**
  This research project focused on visually extracting particulate matter (PM) pollution from a sequence of images captured with a polarizer filter. Developed two novel algorithms for image dehazing and measuring atmospheric scattering.
- **2007: EduCare - Education for Students with Special Needs**
  Researched, designed and developed EduCare (winning software solution in the Egyptian local finals of Microsoft Imagine Cup 2007 competition). EduCare is a comprehensive educational solution for students with special needs. Presented the system to Bill Gates and Microsoft Executives at Microsoft headquarters in Seattle.
- **2005 B.Sc. Thesis: Enhancing the Linux kernel for real-time operation**
  Team-lead of project. Research, implementation and testing of an improved process scheduler queue, enhanced shared memory architecture and more efficient semaphore subsystem.

Selected Publications and Posters

- H. Zhang, **T. El-Gaaly** and A. Elgammal, "**Factorization on View-Object Manifold for Joint Object Recognition and Pose Estimation",** ElSevier Journal of Computer Vision and Image Understanding (CVIU) 2015: Special Issue on Shape Representation Meet Visual Recognition.
- **T. El-Gaaly** et. al., **"A Bayesian Approach to Perceptual 3D Object-Part Decomposition using Skeleton-based Representations",** AAAI 2015.
- T. Senlet, **T. El-Gaaly** and A. Elgammal, **"Hierarchical Semantic Hashing: Visual Localization from Buildings on Maps",** ICPR 2014.
- **T. El-Gaaly**, M. Torki and A. Elgammal, **"Spatial-Visual Label Propagation for Local Feature Classification", oral** paper at ICPR 2014.
- H. Zhang, **T. El-Gaaly** and A. Elgammal, "**Joint Object and Pose Recognition using Homeomorphic Manifold Analysis",** AAAI 2013.
- **T. El-Gaaly** et. al., **"Visual Obstacle Avoidance for Autonomous Watercraft using Smartphones",** AAMAS Workshop on Autonomous Robots and Multi-robot Systems, ARMS 2013.
- **T. El-Gaaly**, M. Torki, A. Elgammal, M. Singh, **"RGBD Object Pose Recognition using Local-Global Multi-Kernel Regression",** ICPR 2012.
- **T. El-Gaaly**, et. al., **"Multi-Modal RGBD Sensors for Object Recognition",** Special Session on RGBD Applications at ACCV 2012.
- **T. El-Gaaly**, M. Torki, A. Elgammal and M. Singh, **"Multi-Modal RGBD Sensors for Object Grasping and Manipulation",** Workshop: "Beyond Grasping: Modern Approaches for Dexterous Manipulation", IROS 2012.
- **T. El-Gaaly**, B. McMahan, A. Elqursh, **"Multi-Segment Zeppelin-Aided Robotic Rover for Ground-Based and Atmospheric Exploration",** Concepts and Approaches for Mars Exploration 2012. Published on Smithsonian/NASA Astrophysics Data System: www.adsabs.harvard.edu/abs/2012LPICo1679.4278E
- B. Falchuk, C. Wu, **T. El-Gaaly** and A. Vashist, **"Skimming Video Action Using Annotated 3D Surfaces",** Eurographics 2011.
- **T. El-Gaaly** and J. Gluckman, **"Measuring Atmospheric Scattering from Digital Image Sequences",** VISAPP 2010.
- **Back to the Future: 3D Object Recognition-by-parts Revisited,** poster @ 8th IGERT Annual Perceptual Science Forum, May 5th, 2014.
- **Multi-Modal RGBD Sensors for Object Grasping and Manipulation,** poster @ Northeast Robotics Colloquium (NERC) @ MIT 2012.
- **RGBD Object Pose Recognition,** poster @ 6th IGERT Annual Perceptual Science Forum, May 7th, 2012

Work Experience

Research/Teaching Assistant, Rutgers University, September 2009 – May 2015
- Teaching: Discrete Structures, Intro to Multimedia, Intro to Artificial Intelligence, Intro to Computers and Applications.

Research Internship, Mitsubishi Electric Research Labs – Summer 2013

Research Internship, Carnegie Mellon University – Robotics Institute – Field Robotics Center, Summer 2012
- Autonomous visual navigation using smartphones on robotic airboats for disaster mitigation and environmental monitoring.

Research Internship, Siemens Corporate Research, Princeton, NJ, June – Summer 2011 and continued collaboration
- Autonomous robot navigation using Xbox Kinect for indoor 3D modeling.

Research Internship, Telcordia, Applied Research – Summer 2010
- Research in activity detection and recognition for video surveillance.

Software Engineer, Emerge Technology, July 2007 – February 2009

Emerge Technology is a media authoring and development company and is a subsidiary of Radius 60 Studios, Los Angeles, CA, USA
- Built automated tools/SDKs for Blu-ray disk authoring for major US studios, e.g. Sony Pictures Entertainment and DreamWorks.

Software Engineer, IBM Egypt, August 2005 – June 2007
- Requirement analysis, design and development of government enterprise systems.
- Certifications: IBM SOA (Service-Oriented Architecture) Solution Designer, Sun Certified Java Programmer (SCJP)

Paper/Journal Reviews: ElSevier Pattern Recognition Journal 2013, CVPR 2011/2012/2015, ICRA 2013, IROS 2013, ICPR 2013/2014.

Relevant Coursework

- Advanced AI, Computer Vision, Pattern Recognition, Software Engineering, Neural Networks & Genetic Algorithms, Computer Architecture, Algorithms and Complexity Theory, Linear Programming, Distributed Systems

Technical Skills

- C/C++, Java, C#, Python, Theano (+ Keras), Neon, OpenCV, OpenGL, Robotic OS (ROS), Matlab, UML, Linux, Point Cloud Library (PCL), Android.

Honors and Awards

2014 HackRU 2014: Winner of Rutgers University Hackathon for the Party Photobot invention (video demo: youtu.be/FekYA-uFAW4)
2013 Axe Apollo Space Academy Competition 2013 Finalist: Ranked 1st in first stage. Selected among 3 Egyptian finalists to go to space
2008 Certificate of Appreciation from the Ministry of Environment in Egypt for an innovative technological eco-solution
2007 Team Winner of Egypt - Microsoft Imagine Cup 2007. Presented project to Bill Gates at Microsoft HQ

Extracurricular Activities

- **Tedx Rutgers 2010, 2011 & 2012 (Independent TED Talks)**: www.tedxrutgers.com, organizing committee and event photographer.
- Built a small tele-presence robotic car using Arduino, camera and Xbee. Worked on obstacle avoidance using smartphone.
- Amateur astronomer, space geek, snowboarder and started private pilot license training - summer of 2013