Dimitrios Kanoulas

College of Computer & Information Science
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Current Position

Ph.D Candidate, College of Computer & Information Science, Northeastern University

Research Interests

Computer Vision and Robotics: 3D Computer Vision and Perception, Legged Robot Locomotion, Probabilistic Robotics, Simultaneous Localization and Mapping (SLAM), Machine Learning in Computer Vision (Object Recognition and Classification).

My research aims to apply 3D perception in robotics and computer vision. I am interested in developing new real-time algorithms for sensing, real-time map building, and self/ environment modeling. Experimental justification of theory plays a central role in my research philosophy. My dissertation work focuses on perception for articulated robot locomotion on very uneven 3D terrain by modeling the environment with curved surface contact patches including statistical models of uncertainty. My research internship at INRIA in 2012 focused on developing new 3D local features for vehicle recognition using machine learning in a probabilistic framework.

Algorithms and Complexity: Algorithmic Game Theory, Approximation Algorithms, Combinatorial and Linear Optimization, Design and Analysis of Algorithms.

Education

Ph.D. in Computer Science, September 2010 - August 2014

College of Computer and Information Science, Northeastern University, Boston, USA.
Concentration Area: 3D Computer Vision and Perception, Legged Robot Locomotion
Thesis: Curved Surface Patches for Rough Terrain Perception.
Advisor: Marsette Vona

M.S. in Computer Science, September 2008 - May 2010

College of Computer and Information Science, Northeastern University, Boston, USA.
Concentration Area: Algorithmic Game Theory
Advisor: Rajmohan Rajaraman, *co-Advisor*: Ravi Sundaram
GPA: **4.0/4.0**

Diploma in Computer Science, September 2003 - May 2008
(5-year B.Sc. degree with thesis)

Computer Engineering and Informatics, University of Patras, Patras, Greece.

Thesis: Approximate Nash Equilibrium: "Conducting Theoretical and Experimental Research on Optimal Algorithms that can Result in Better Approximate Nash Equilibria in Bi-Matrices Games."

Advisor: Paul G. Spirakis, *co-Advisor*: Haralampos Tsaknakis

GPA: **8.43/10** (ranked 5 of 120)

Theses

Curved Surface Patches for Rough Terrain Perception,
Ph.D. thesis, College of Computer and Information Science, Northeastern University.
Advisor: Marsette Vona.

Approximate Nash Equilibrium: *"Conducting Theoretical and Experimental Research on Optimal Algorithms that can Result in Better Approximate Nash Equilibria in Bi-Matrices Games"*, *Bachelor's Thesis, University of Patras, Computer Engineering and Informatics Department, July 2008.*
Advisors: Paul Spirakis and Haralampos Tsaknakis.

Conference Publications

Bio-Inspired Rough Terrain Contact Patch Perception,
Dimitrios Kanoulas and Marsette Vona.
In the 2014 IEEE International Conference on Robotics and Automation (**ICRA 2014**).

Sparse Surface Modeling with Curved Patches,
Dimitrios Kanoulas and Marsette Vona.
In the 2013 IEEE International Conference on Robotics and Automation (**ICRA 2013**).

Cache me if you can: Capacitated Selfish Replication in Networks,
Ragavendran Gopalakrishnan, **Dimitrios Kanoulas**, Naga Naresh Karuturi, C. Pandu Rangan, Rajmohan Rajaraman, and Ravi Sundaram.
In the Latin American Symposium on Theoretical Informatics (**LATIN 2012**).

Curved Surface Contact Patches with Quantified Uncertainty,
Marsette Vona, and **Dimitrios Kanoulas**.
In the 2011 IEEE/RSJ International Conference on Intelligent Robots and Systems (**IROS 2011**).

Performance evaluation of a descent algorithm for bi-matrix games,
Haralampos Tsaknakis, Paul Spirakis and **Dimitrios Kanoulas**,
In the 4th Workshop on Internet and Network Economics 2008 (**WINE 2008**).

Workshops/Posters

The Surface Patch Library (SPL),
Dimitrios Kanoulas and Marsette Vona.
In the 2014 IEEE International Conference on Robotics and Automation Workshop: MAT-LAB/Simulink for Robotics Education and Research (**ICRA 2014**).

Intensity and Depth Data Integration for Vehicle Detection,
Dimitrios Kanoulas, Alexandros Makris, Mathias Perrollaz, Christian Laugier.
For the NSF REUSSI meeting, CSU, June 2014.

Surface Patches for Rough Terrain Perception,
Dimitrios Kanoulas,
In the Northeast Robotics Colloquium, Second Edition (poster), (**NERC 2013**).

Journal Articles

Cache me if you can: Capacitated Selfish Replication in Networks,
Ragavendran Gopalakrishnan, **Dimitrios Kanoulas**, Naga Naresh Karuturi, C. Pandu Rangan,
Rajmohan Rajaraman, and Ravi Sundaram,
(under submission)

Unrefreed Papers

CTY Robotics and Applied Computing,
Dimitrios Kanoulas and Marsette Vona,
CCIS, Northeastern University, December 2012.

Cache me if you can: Capacitated Selfish Replication in Networks,
Ragavendran Gopalakrishnan, **Dimitrios Kanoulas**, Naga Naresh Karuturi, C. Pandu Rangan,
Rajmohan Rajaraman, and Ravi Sundaram,
arXiv:1007.2694v2, CCIS, Northeastern University, December 2011.

Performance evaluation of a descent algorithm for bi-matrix games,
Haralampos Tsaknakis, Paul Spirakis, and **Dimitrios Kanoulas**,
RACTI-RU1-2008-36, CEID, University of Patras, September 2008.

Teaching Experience

Northeastern University (2008 - 2012)

Teaching Assistant for the courses:

1. **"CSU390: Theory of Computation"**: This undergraduate course serves as an introduction to formal models of languages and computation.
   [**Fall 2008, Spring 2009**].

2. **"CS4300: Computer Graphics"**: This undergraduate course focuses on fundamental mathematics, algorithms, data structures, and programming techniques that are at the core of modern 2D and 3D graphics applications in practice.
   [**Spring 2011**].

3. **"CS5010: Program Design Paradigms"**: This graduate course focuses on designing programs, from problem analysis to the development of test suites.
   [**Fall 2011, Spring 2012**].

Research Experience

CCIS, Northeastern University (2010 - present)

Working with **Prof. Marsette Vona** on:

Modeling, Sensing, and Mapping Curved Surface Contact Patches.

Segmentation and Local Feature Extraction for Very Uneven 3D Terrain.

e-Motion, INRIA, (May 2012 - August 2012)

Working with **Prof. Christian Laugier** on:

3D Perception for Vehicle Recognition.

CCIS, Northeastern University (2008 - 2010)

Working with **Prof. Rajmohan Rajaraman** and **Prof. Ravi Sundaram** on:

Game Theoretic Modeling of Distributed Selfish Replication in Networks.

CEID, University of Patras (2007 - 2008)

Working with **Prof. Paul G. Spirakis**, and **Dr. Haralampos Tsaknakis** on:

Theoretical and Experimental Research on Approximate Nash Equilibrium.

Software

Surface Patch Library (SPL) (in Matlab): [**link**]
SPL includes models of 10 types of curved surface patches and an algorithm to fit them to potentially noisy range sensor data. Uncertainty is quantified throughout using covariance matrices.

Approximate Nash Equilibria Library (aNEL) (in C and Matlab): TBA.
Implementation of approximate Nash Equilibrium algorithms.

Presentations

Invited Talks

"3D Perception for Car Regonition", NSF–REUSII, Colorado State University, June 2014.

"From Noisy Point Clouds to Curved Contact Patches", GRASP group, UPenn, June 2013.

"From Noisy Point Clouds to Curved Contact Patches", CSL group, National Technical University of Athens, May 2013.

"Vehicle Recognition using Stereo Camera", Google, Boston, March 2013.

"Detecting Contact Patches in Noisy 3D Sampled Data", PERCEPTION group, INRIA, Grenoble, July 2012.

"Detecting Contact Patches in Noisy 3D Sampled Data and Vehicle Recognition using stereo vision", e-motion group, INRIA, Grenoble, July 2012.

"Detecting Contact Patches in Noisy 3D Sampled Data", LAAS-CNRS, Toulouse, July 2012.

Selected Other Talks

"Bio-Inspired Rough Terrain Contact Patch Perception", ICRA conference, Hong Kong, June 2014.

"The Surface Patch Library (SPL)", ICRA 2014 workshop: MATLAB/Simulink for Robotics Education and Research, Hong Kong, June 2014.

"Curved Surface Patches for Rough Terrain Perception", Thesis Proposal, CCIS, Northeastern University, December 2013.

"Sparse Surface Modeling with Curved Patches", ICRA conference, Karlsruhe, May 2013.

"Cache me if you can: Capacitated Selfish Replication in Networks", LATIN, Arequipa, April 2012.

"Curved Surface Contact Patches with Quantified Uncertainty", IROS, San Francisco, September 2011.

"Open Source in Robotics", PhD seminar, CCIS, Northeastern University, June 2011.

"Capacitated Caching Games", SCAN seminar, CCIS, Northeastern University, February 2011.

"Distributed Selfish Replication Problem: A game theoretic approach", SCAN seminar, CCIS, Northeastern University, November 2009.

Courses

Ph.D. courses, Northeastern University, CCIS, Boston, MA, USA

Machine Learning (CS 6140, Fall 2012, Prof. J. Aslam),

Robotic Science and Systems (CS 4610, Fall 2011, Prof. M. Vona),

Surface Patch Modeling, Perception, and Mapping (CS 8982, Spring 2011, Prof. M. Vona),

Applied Geometric Representation and Computation (CS 7380, Fall 2010, Prof. M. Vona),

Topics in Articulated Robots (CS 8982, Spring 2010, Prof. M. Vona),

Intensive Computer Systems (CS 7600, Spring 2010, Prof. P. Desnoyers),

Algorithmic Power Tools (CS 7880, Fall 2009, Prof. R. Rajaraman),

Principles of Programming Languages (Intensive) (CS 7400, Fall 2009, Prof. M. Wand),

Theory of Computation (CS G714, Spring 2009, Prof. R. Rajaraman),

Gems of Theoretical Computer Science (CS G399, Spring 2009, Prof. E. Viola),

Advanced Algorithms (CS G713, Fall 2008, Prof. E. Viola),

Applications of Information Theory to Computer Science (CS G195, Fall 2008, Prof. J. Aslam).

Selected Projects

Differential drive implemention on an AVR-based microcontroller board (Pololu Orangutan SVP). (Fall 2011, Implementation in C).

Obstacle avoidance and navigation, arm kinematics and grasping, object detection, and visual servoing implementation on a PandaBoard ARM processor running Ubuntu using OpenCV. (Fall 2011, Implementation in Java/OpenCV).

Camera calibration, generation of fast 3D wireframe graphics using the pinhole camera model, 3D pose tracking of known objects, sparse pyramid Lucas-Kanade algorithm and Kalman Filter to track image features, and drawing error ellipses for covariance matrices using OpenCV.
(Fall 2010, Implementation in C++/OpenCV).

Simulation of a redundant n-link planar revolute chain robot, using forward and inverse kinematics.
(Fall 2010, Implementation in Matlab).

Implementation of Raibert hopper robot simulator for sloped terrain.
(Spring 2009, Implementation in Matlab).

Implementation of Tsaknakis/Spirakis algorithm for approximate Nash Equilibria.
(Spring 2008, Implementation in C, Matlab and CPLEX).

Lempel.Ziv compression algorithm with compression ratio roughly 2 on English texts.
(Fall 2008, Implementation in Python).

Development of a clustering algorithm for eye movement.
(Spring 2008, Implementation in Matlab).

Neural network implementation of a Full Adder.
(Spring 2008, Implementation in Matlab).

Design and implementation of a parallel algorithm for solving the shortest path problem.
(Fall 2007, Implementation in C).

Design and implementation of a client-server system for time scheduling, with the ability to receive a large number of processes and schedule them in round robin or shortest job first fashion.
(Fall 2007, Implementation in C).

Implementation of a /proc Filesystem and the memory management module of the kernel, for MINIX operating system.
(Spring 2007, Implementation in C).

Computer Skills

Programming languages: Matlab, C, C++, Java, Scheme/Racket, LaTeX.

Computer Vision and Robotics Programming: OpenCV, PCL, ROS.

Professional Services

Reviewer: IROS 2014, IROS 2013, NEU Outstanding Graduate Student Awards '13, IEEE-RAM 2013, ICRA 2013, Humanoids 2012, IROS 2011, CCC 2010

External Reviewer: SODA 2010, GLOBECOM 2009

Honors & Awards

Northeastern University (2008 - 2014)

IEEE ICRA NSF Travel Support ($750) (Summer 2014).

University of Patras (2003 - 2008)

Ranking in top 5% of the class for all the academic years between 2003-2008.

Miscellaneous

Foreign languages

Greek (native), English (fluent).

My Erdos Number: 3

[Laszlo Lovasz (1) - Rajmohan Rajaraman (2) - Dimitrios Kanoulas (3)]

University Activities

Northeastern University
Organize SCANS and PhD Seminar: Fall 2009, Spring 2010.
Organize Algorithmic Game Theory Reading Group: Fall 2008, Spring 2009.

University of Patras
Undergraduate Student Representative 2003-2008

References Available Upon Request

Last updated: August 18, 2014
`http://www.ccs.neu.edu/home/dkanou/cv/CV.pdf`