Mehmet Kemal Kocamaz

4123 Newell Simon Hall, Carnegie Mellon University, Pittsburgh, PA 15213

kocamaz@gmail.com

Web-site: http://www.cs.cmu.edu/~mehmetk

EMPLOYMENT

- **Postdoctoral Fellow** — May 2014 - Present
  Robotics Institute, Carnegie Mellon University (in **NavLab**)
- **Research Intern** — May 2012 - September 2012
  Mitsubishi Electric Research Labs (Worked with **Prof. Fatih Porikli**)
- **Research and Teaching Assistant** — September 2008 – 2014
  Dynamic Vision Lab, University of Delaware
- **Software Engineer** — August 2007 – August 2008
  R&D Department, Manhattan Associates Inc.
- **Research and Teaching Assistant** — August 2005 – May 2007
  Computer Science Department, Rensselaer Polytechnic Institute

EDUCATION

PhD Computer Science — 2008 – 2014
University of Delaware — GPA: 3.9/4.0

- Research Interests: Computer Vision, image segmentation, real-time object, road and trail tracking for Intelligent Robots. Multimodal human detection, object tracking and refinement
- Advisor: **Prof. Christopher Rasmussen**

M.S. Computer Science — 2005 – 2007
Rensselaer Polytechnic Institute — Troy, NY

- Thesis Title: "Region-growing and distribution matching medical image segmentation algorithms"

B.Sc. Computer Science — 2001 – 2005
University of Southern California — Los Angeles, CA

HONORS and AWARDS

- **Outstanding** Teaching Assistant Award, University of Delaware, 2013
- **Winner** of 19th International Intelligent Ground Vehicle Competition**, First place** in Autonomous Challenge part among **57 robots from 6 countries**, 2011
- **3rd Place** in Autonomous Challenge part of 18th International Intelligent Ground Vehicle Competition, 2010
- **Winner** of 17th International Intelligent Ground Vehicle Competition**, First place** in Autonomous Challenge part, 2009
- School of Engineering **Fellowship** for **Top** Engineering Student, University of Southern California, 2003
- Dean's List, Department of Computer Science, University of Southern California, 2001-2004
- Turkish Government Undergraduate Study **Fellowship**, full support to study at USC, 2001-2005
- Ranked **18th** among **one and half million students** in Turkey University Entrance Examination, 2000
- **Fellowship** from Bilkent University for BS, Ankara – Turkey, 2000

RESEARCH PROPOSAL EXPERIENCES

- **Measuring Pedestrian Wait-Time at Intersections**

  Role: Co-PI
  Sponsor: Center of Technologies for Safe and Efficient Transportation, CMU
  Budget: 25K
  Start Date: October 2015 **Expiration Date:** January 2016
  Info: Adaptive traffic lights have the potential to significantly facilitate car travel and reduce congestion. However, other road users, especially pedestrians, may suffer longer wait times if they are not taken into account by the adaptive algorithms. The objective of this project is to bring greater insight into the impact of such smart traffic light systems to the pedestrian flow. The proposed system aims to measure the waiting time of the pedestrians at the key intersections using monocular camera data.

- **Pedestrian Detection for the Surtac Adaptive Traffic System**

  Role: Co-PI
  Sponsor: Center of Technologies for Safe and Efficient Transportation, CMU
  Budget: 100K
  Start Date: January 2016 **Expiration Date:** December 2017
  Info: Surtac, the real-time adaptive traffic signal control system, has been demonstrated to significantly improve traffic flow on multiple performance metrics, including reductions of 25% of travel time and 40% wait time for motor vehicles. The objective of this project is to bring this same intelligence to pedestrian traffic, which has, thus far, not been targeted by Surtrac deployments. Phase 1 of this project will analyze pedestrian traffic at multiple Surtrac deployments. Phase 2 will add additional sensing and processing capabilities to determine the presence of pedestrians waiting to cross the intersections of Pittsburgh

PUBLICATIONS

Book Chapters

- Rasmussen C., Lu Y., Kocamaz M.K., "A trail-following robot which uses appearance and structural cues", FSR , Springer Tracts in Advanced Robotics, Volume 92, Page 265-279, Springer, 2012

Journals

- Kocamaz M.K., Rasmussen C., "Approaches for Automatic Low Dimensional Human Shape Refinement with Priors or Generic Cues using RGB-D Data", Journal of Image and Vision Computing, Volume 40, 16-27, 2015
- Kocamaz M.K., Rasmussen C., "Multimodal Point-wise Object Tracker with RGB-D Data ", Submitted to Journal of Computer Vision and Image Understanding
- Kocamaz M.K., Porikli Fatih, "Unconstrained 1D Range and 2D Image Based Human Detection and Segmentation", In Submission to Journal of Machine Vision and Applications

Conferences

- Laddha A., Kocamaz M.K., Hebert M., Self-Supervised Road Detection in Monocular Images using Maps", Submitted to IEEE Intelligent Vehicles Symposium- 2016
- Kocamaz M.K., Pires B., Gong J. "Vision based Counting of Pedestrians and Cyclists", IEEE Winter Conference on Applications of Computer Vision - 2016
- Kocamaz M.K., Porikli Fatih, "Unconstrained 1D Range and 2D Image Based Human Detection", IEEE/RSJ International Conference on Intelligent Robots and Systems. **Oral** Presentation - 2013
- Kocamaz M.K., Lu Y., Rasmussen C., "Deformable Object Shape Refinement and Tracking Using Graph Cuts and Support Vector Machines", International Symposium on Visual Computing - 2011

- Rasmussen C., Lu Y., Kocamaz M.K., "Integrating Stereo Structure for Omni-directional Trail Following", IEEE/RSJ International Conference on Intelligent Robots and Systems. **Oral** Presentation - 2011
- Kocamaz M.K., Rasmussen C., "Automatic Refinement of Foreground Regions for Robot Trail Following", IEEE International Conference of Pattern Recognition. **Oral** Presentation - 2010
- Rasmussen C., Lu Y., Kocamaz M.K., "Trail Following with Omni-directional Vision", IEEE/RSJ International Conference on Intelligent Robots and Systems. **Oral** Presentation - 2010
- Rasmussen C., Lu Y., Kocamaz M.K., "Appearance Contrast for Fast, Robust Trail-Following", IEEE/RSJ International Conference on Intelligent Robots and Systems. **Oral** Presentation - 2009

Others

- Kocamaz M.K., Kaya A., Kang Y.E, Francois A., "The Virtual Daguerreotype", IMSC Technical Report, University of Southern California -May 2003

PATENT DISCLOSURES

- Porikli Fatih, Kocamaz Mehmet K., "Method for Detecting Persons Using 1D Depths and 2D Texture ", (13,897,517), June 2013

RESEARCH PROJECTS

- **Pedestrian and Bicycle Counting using Monocular camera data** **January 2015 – Present**

  NavLab, Carnegie Mellon University, Pittsburgh, PA

  Info The goal of this project is to count the pedestrians and bicycles using the data of stationary cameras installed near pedestrian and bike lanes in the city. For this purpose, I developed an object counting system. This method first detects and distinguishes between the bikes and pedestrians in a cascaded way, and then it tracks the classified subjects. It combines color, geometric shape prior, moving direction and background models to improve the output of conventional object detectors.

- **Obstacle and Road Detection on Moving Platforms** **June 2014 – January 2015**

  NavLab, Carnegie Mellon University, Pittsburgh, PA

  Info In this project, I have been investigating methods for fusing Geographical Information System (GIS) database and camera data to detect the obstacles and road. This system requires to run robustly and real-time on the moving platforms, such as cars, and smart phones. External GIS knowledge is retrieved from OpenStreetMap as the geometry of 2D bird eye view. This low level map information defines some semantic labels of the scene structure, such as roads and buildings. Projecting this knowledge to the image space helps to reduce the search space and also increase the accuracy of the detection. The preliminary result of the algorithm is promising in several datasets

- **Multimodal Point-wise Complex Object Tracking** **August 2012 - November 2013**

  Dynamic Vision Lab, University of Delaware, Newark, DE

  Info A point-wise tracking method which fuses the structural and visual cues obtained from the depth and color images is developed. The point-wise features of the object are learnt by Random Forest Classifier. The displacement of the object is estimated by SIFT keypoint matching method over time. The confidence score of a point being inside the object is achieved from the RF classifier. These confidence scores are given to graph cut framework to determine final borders of the object. For some results:
  https://www.youtube.com/watch?v=V2aHpfqaPSI

- **Automatic Low Dimensional Human Shape Refinement** **August 2012 - November 2013**

  Dynamic Vision Lab, University of Delaware, Newark, DE

Info A method which refines a given low dimensional human shape, such as a bounding box, to obtain the pixel-wise mask of the human is developed. It fuses the features achieved from the color and depth images of Kinect sensor. A pixel-wise human descriptor which incorporates the shape of human, geodesic distance and local normal information on the human is developed. The descriptors are trained in random forest classifier framework. Low order potentials, such as color discontinuity and random forest classifier retrieved shape confidence information, and high order potentials, such as pre-determined ground plane, are jointly combined in multi layer graph cut framework. Final detailed pixel-wise human mask is obtained by performing the graph cut in this multilayer graph

- **Multimodal Human Detection** **June 2012 – September 2012**

  Mitsubishi Electric Research Labs, Cambridge, MA (Worked with **Prof. Fatih Porikli**)

  Info An accurate and computationally very fast multi-modal human detector is developed. This 1D+2D detector fuses 1D range scan and 2D image information via an effective geometric descriptor and a silhouette based visual representation within a radial basis function kernel support vector machine learning framework. Unlike the existing approaches, the proposed 1D+2D detector does not make any restrictive assumptions on the range scan positions, thus it is applicable to a wide range of real-life detection tasks. Extensive experiments demonstrate that the 1D+2D detector works robustly under challenging imaging conditions and achieves several orders of magnitude performance improvement while reducing the computational load drastically. For some results: http://www.youtube.com/watch?v=6lJ81oKCjPk

- **Autonomous Driving and International Intelligent Ground Vehicle Competition** **2009, 2010, 2011**

  Dynamic Vision Lab, University of Delaware, Newark, DE

  Info Our unmanned ground vehicle won the **1st place** in 2009 and 2011, **3rd place** in 2010 Autonomous Challenge part of International Intelligent Ground Vehicle Competition among ~50 robots. I worked on the line detection, tracking, and obstacle detection modules of the robot. A part of our run in 2011 competition can be watched on http://www.youtube.com/watch?v=dwsWAw99LN0

- **Deformable Object Segmentation and Tracking via Graph Cuts** **September 2010 – June 2012**

  Dynamic Vision Lab, University of Delaware, Newark, DE

  Info The purpose of this work is to obtain a refined segmentation of an object given a coarse initial segmentation of it. One line of investigation modifies the standard graph cut method by incorporating color and shape distance terms, adaptively weighted at run time to try to favor the most informative cue given visual conditions. Furthermore, single-frame refinement method is extended to serve as the basis of the tracker which works for a variety of object types with complex, deformable shapes. For some results: http://www.youtube.com/watch?v=adPuqG0hGss

- **Dense Stereo for Omni-directional Cameras** **January 2010 – January 2011**

  Dynamic Vision Lab, University of Delaware, Newark, DE

  Info The goal of this work is to detect obstacles, both positive and negative, through 3D reconstruction, which can be used as a cue for robot navigation. We mounted stereo fisheye cameras on a ground vehicle (robot). Stereo is used to recover depth, and thus to perform scene reconstruction for obstacle detection. Omni directional cameras provide much wider views than regular lens cameras, and the robot can not only "see" what is in front of it, but also "see" what is behind it. A semi global block matching function (SGBM) is applied to the stereo image pairs to generate disparity images. With disparity, we reproject the image to 3D for scene reconstruction

- **Trail Refinement** **September 2009 – January 2010**

  Dynamic Vision Lab, University of Delaware, Newark, DE

  Info In this work, the suitability of several previously published segmentation algorithms both in terms of agreement with ground truth and speed on a range of trail images with diverse appearance characteristics are compared. These algorithms include generic graph cut, a shape-based version of graph cut which employs a distance penalty, GrabCut, and an iterative superpixel grouping method. Some modifications are made in the algorithms to make them work better for our data sets

- **Trail Detection and Tracking with Particle Filters** **September 2008 – September 2010**

Dynamic Vision Lab, University of Delaware, Newark, DE

Info This project describes a framework for detecting continuous trails in isolated images and tracking them over image sequences for autonomous robot navigation. Proceeding from a shape assumption that the trail region is approximately triangular under perspective, an objective function is formulated in terms of trail appearance, which drives an efficient multi-scale particle filter. A hypothetical trail triangles appearance likelihood is based on a robust measure of color and brightness contrast with and symmetry between flanking triangular regions. The absolute trail likelihood correlates well with confidence that a trail is even visible; the system uses this to switch between appearance cue sets in order to maximize accuracy under changing visual conditions

- **Medical CT and Ultrasound Images Segmentation** **September 2005 – May 2007**

Computer Vision Lab, Rensselaer Polytechnic Institute, Troy, NY

Info Implemented semi-automated, multi-label, random walker, image segmentation algorithms for medical applications. Designed and implemented a semi-automated region-growing and distribution matching image segmentation algorithm

- **Virtual Mirror and Daguerrotype** **September 2003 – May 2005**

Integrated Media Systems Center, University of Southern California, Los Angeles, CA

Info Worked on algorithms for dataflow processing of data streams, algorithms on image processing and video analysis. Implemented data transformation algorithms for video streams. Some image processing (interpolation, rectification and compositing) algorithms are implemented to find desired intermediary images by interpolating images which are taken from different angles of an object

INDUSTRY PROJECTS & EXPERIENCES

- **Technical Lead of Wishyland.com** **2013 – Present**

Info Designed and implemented an online shopping information system. The system helps the companies to reach out their customers who wait for the deals. Categories of the products can be organized by the companies to offer to their customers. The customers can configure their interests, called as wishy, then wait for an information message from wishyland. The system is implemented in PHP and C#

- **Captcha Web Security Images Solver** **2010 – Present**

Info Cracked a well known web-site's image captcha system. An automatic image captcha solver program based on real time machine learning techniques has been implemented. The cookie management system of the internet browsers is embedded to the system to allow multiple connections at the same time. The program is still active and working

- **Technical Lead of motongue.com** **2010 – 2014**

Info Designed and implemented real time communication software, called as KM Whiteboard, which provides an infrastructure for teaching and meeting of the multiple users (students, teachers, parents, and admins) in the same class room. KM Whiteboard has a rich way of communication tools, such as video/audio, chat, document sharing/displaying, shared drawing, and document management system. The software consists of two main parts, KM Whiteboard Server and Client. The source code of the system is ~250,000 lines. It is implemented mainly in C#, Silverlight, Actionscript and C++

- **Software Engineer** **August 2007 – August 2008**

Research and Development Department, Manhattan Associates Inc., Atlanta, GA

Info Implementing and testing EAI (Enterprise Application Integration) Server message routing and translating modules. Implementation of new layers to support different file formats on top of existing EAI system using Java/J2EE

PRESENTATIONS & TALKS

- "Low Dimensional vs Point-wise Complex Object Detection, Refinement and Tracking", School of Computer Science in Carnegie Mellon University, December 2013
- "Automatic Refinement of Foreground Regions for Robot Trail Following", at International Conference of Pattern Recognition, 2010
- "Warthog", at 17th Autonomous Ground Vehicle Ground Vehicle Competition, 2009
- "Robust Trail Segmentation and Tracking Based on Color", at 2009 University of Delaware Research Day, 2008.
- "Simulation of Virtual Daguerreotype", at the 7th Annual IMSC Student Conference, 2003

COMPUTER SKILLS

Languages

C, C++, Matlab, C#, Java, Silverlight, Actionscript, JavaScript, Perl, JSP/Servlets, Java beans