Murat Ambarkutuk

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Education

PhD in Computer Engineering **2018 – August 2023 (Anticipated)**
The Bradley Department of Electrical and Computer Engineering at Virginia Tech *Blacksburg, VA*
Dissertation: A Sensor Fusion Technique for Gait Analysis from Structural Vibration and Computer Vision

MS in Mechanical Engineering **2015 – 2018**
Mechanical Engineering at Virginia Tech *Blacksburg, VA*
Thesis: A Grid based Indoor Radiolocation Technique Based on Spatially Coherent Path Loss Model

BS in Mechatronics Engineering **2008 – 2013**
Mechatronics Engineering Department at Kocaeli University *Kocaeli, Turkey*
Thesis: Box Dimensioning System with Kinect Sensor

Technical & Language Skills

Languages: Python, MATLAB, C, C++, HTML/CSS, JavaScript, PHP
Frameworks: OpenCV, numpy, scipy, matplotlib, scikit-learn, scikit-image, Flask, keras, Tensorflow, Jupyter, ROS, LaTeX
Technologies: Linux, Version Control, GitHub, GitLab, CI/CD
Language Proficiency: Turkish (Native), English (Proficient), German (Novice)

Relevant Coursework

- Robust Estimation & Filtering
- Computer Vision
- Advanced Computer Vision
- Advanced Machine Learning
- Bayesian Robotics
- Experimental Robotics
- Experimental Methods & Signal Processing
- Advanced Robotics & Automation

Relevant Professional Experience

Baykar Defense **2018 – 2020**
Computer Vision Engineer developing orthographical maps with aeral photos taken by autonomous UAVs. *Remote*

- Developed a signal processing algorithm to filter the inertial measurements of the UAV and calculate the pose of the cameras in the air.
- Developed an algorithm to sync the calculated poses & inertial measurements to the images.
- Developed an iterative Computer Vision algorithm to project the corners of the images to the ground to generate the initial guess while considering the elevation changes in the scene.
- Developed a Sensor Fusion algorithm to correct results of the previous stages of the map-making algorithm with statistical representation.
- Implemented Test-driven Development paradigm in the dev-team. On that front, generated tests to check coverage, style requirements, and performance & accuracy of the developed algorithms.
- Architected the CI/CD pipeline to automate the aforementioned tests and generated automated reports from the results of the tests.

Projects

Mentorship Web Platform for School of Construction
Supervisors: A Akanmu, J Iorio | Website | Sponsor: MLSoC DEI Committee

- Developed a Web application to match mentees to mentors by considering mentree preferences and mentor expertise.
- Developed a backend with RESTful interface to manipulate the data in consideration & expose some features to the users. Developed a frontend system that let's users & administrator enter data into the backend system and organize information visually.

Analysis of Operational Modes of Deployable Booms in Cube Satellites | Ut ProSat - I
Supervisors: J Black, L Harding | Website | Sponsor: Virginia Space Space@VT & NASA

- Contributed to the hardware selection and design process in the manufacturing of a cube satellite that is missioned to test deployers in lower-orbit space.
- Compile the mission plan, provide premilinary analysis of data and power budget specifically with the selected components of the deployer mechanism.
- Developed the necessary embedded software and test procedures required by the deployer subsystem.

Sensor Fusion for Occupant Localization in Smart Buildings

Advisor: P Plassmann & CF Jones | Related publications: [9, 8, 2, 1]

- Developed a robust algorithm that estimates heel-strike locations from the accelerometer measurements of a vibrating floor.
- Developed a Computer Vision-based algorithm to localize heel-strike locations from images taken by a stereoscopic camera.
- Developed a sensor fusion framework to incorporate the vibration- and vision-based heel-strike locations.
- Developed a combined simulation environment that can generate the vibration and visual information necessary for the validation of the algorithms developed.
- Quantified the efficacy and accuracy of implementations with simulations and controlled experiments.

Quantification of Collaboration and Communication among Students in a Smart Classroom

Advisors: T Baird, PA Tarazaga | News Article | Project Website

- Designed a sensor-suite for a smart classroom to quantify the collaboration among students.
- Developed a backend control the sensor-suite.
- Exposed the backend via a WEB-app to remotely control and monitor the system.

A Grid-based Indoor Radiolocation Technique based on Spatially Coherent Path Loss Model

Advisor: T Furukawa | Publications: [7]

- Derived a probablistic framework of a passive radio-localization technique under multipath propagation that can determine the location of different entities, namely, occupants, robots, and invenvorty, in indoor enviroments.
- Developed the localization algorithm based on the probablistic framework.
- Validated the efficacy of the algorithm with controlled experiments whose results were presented at IEEE RAS conference.

Community Service & Leadership

Graduate Student Ambassador
The Bradley Department of Electrical and Computer Eng.

IEEE Robotics and Automation Society
Student Member & Reviewer

Society of Experimental Mechanics
Student Member

Turkish Student Assoc. at Virginia Tech
Secretary

Scrum Master
Vibrations, Adaptive Structures, and Testing Laboratory, at Virginia Tech

Relevant Publications

[1] S. Alajlouni, **Ambarkutuk, Murat**, and P. Tarazaga. Towards the detection and localization of multiple occupant footsteps from vibroacoustic measurements. In *Dynamics of Civil Structures, Volume 2: Proceedings of the 38th IMAC, A Conference and Exposition on Structural Dynamics 2020*, page 193. Springer Nature, 2020.

[2] S. Alajlouni, V. V. S. Malladi, and **Ambarkutuk, Murat**. Investigation of using log-spectrum averaging (cepstral averaging) for blind reconstruction of an unknown impact input force. Springer Nature, 2022.

[3] H. E. Güner, **Ambarkutuk, Murat**, L. Bilginer, and C. Oysu. Magnetic braking and speed stabilization. In *Proceedings of 18th International Conference*, pages 83–86. Proceedings of 18th International Conference. Mechanika 2013., 2013.

[4] H. E. Guner, O. Tekelioglu, **Ambarkutuk, Murat**, L. Bilginer, A. Aşkın, and S. Erkan. Distance mechatronic laboratory for sme's universities and vocational high schools in turkey. In *The 16th International Conference on Mechatronics, Mechatronica 2014*. Brno University of Technology, 2014.

[5] H. E. Guner, O. Tekelioglu, **Ambarkutuk, Murat**, L. Bilginer, A. Aşkın, and S. Erkan. Meslek yüksek okullari ve üniversiteler için internet tabanli mekatronik laboratuvari uygulamasi. In *3rd International Symposium on Innovative Technologies in Engineering and Science, 215*, 2015.

[6] H. Ocak, **Ambarkütük, Murat**, G. Küçükyıldız, and S. Karakaya. Image processing based package volume detection with kinect. In *2015 23nd Signal Processing and Communications Applications Conference (SIU)*, pages 515–518. IEEE, 2015.

[7] **Ambarkutuk, Murat** and T. Furukawa. A grid-based indoor radiolocation technique based on spatially coherent path loss model. In *2017 IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI)*, pages 220–226. IEEE, 2017.

[8] **Ambarkutuk, Murat** and P. Tarazaga. Uncertainty analysis of an occupant localization technique based on simulated structural vibrations. Springer Nature, 2022.

[9] **Ambarkutuk, Murat**, S. Alajlouni, and P. Tarazaga. A sensor fusion technique for spatial gait parameters from structural vibration and computer vision. MDPI Sensors, 2022.