Melih Can Yesilli

mcanyesilli@gmail.com | www.melihcanyesilli.com

EDUCATION

Michigan State University, East Lansing, MI — August 2018 – May 2022
Doctor of Philosophy, Department of Mechanical Engineering
Thesis Title: Topological Data Analysis and Machine Learning Framework for Studying Time Series and Image Data
Advisor: Dr. Firas Khasawneh

Middle East Technical University, Ankara, Turkey — September 2013 – June 2018
Bachelor of Science, Department of Mechanical Engineering

WORK EXPERIENCE

Michigan State University — East Lansing, MI
Graduate Research Assistant — August 2018 – May 2022

Chatter Detection in Machining Using Machine Learning

- Developed an approach that can classify unstable and stable time series with 96% accuracy using Topological Data Analysis and machine learning
- Developed the machine learning module of Python package named teaspoon
- Diagnosed chatter in machining signals with 98% accuracy using similarity measures of time series and K-Nearest Neighbor algorithm
- Achieved 95% accuracy using transfer learning approach for detecting unstable machining signals

Surface Texture Analysis Using Machine Learning

- Reduced the time needed to compute surface modes by 99.6% by developing an automatic threshold selection algorithm for Discrete Cosine Transform
- Obtained 95% classification accuracy for surface texture classification using information theory and image processing
- Classified surface images with 96% accuracy using Topological Data Analysis

Tool Wear Identification

- Developed an automatic algorithm that selects sensitive frequencies in Fourier spectrum for feature extraction with Discrete Wavelet Transform
- Developed Topological Data Analysis based approach for tool wear analysis
- Proved that usage of expensive force sensors is redundant

Roketsan — Ankara, Turkey
Engineering Trainee — November 2017 – April 2018

- Focused on navigation of aerial vehicles and Inertial Measurement Units (IMU)
- Developed Kalman Filter based Attitude and Heading Reference System

Intern — June 2017 – July 2017

- Designed complimentary filter based Attitude and Heading Reference System
- Conducted experiments using gyroscope and accelerometer

TEI - TUSAS Engine Industries — Eskisehir, Turkey
Intern — July 2016 – August 2016

- Conducted cost analysis for two aircraft parts named as front rotating air seal and spool of a jet engine
- Inspected manufacturing processes applied in the factory such as milling, turning, shot peening, welding, deburring, and heat treatment

TEACHING EXPERIENCE

Michigan State University — East Lansing, MI
Graduate Teaching Assistant — January 2019 – present

- ME451L - Control Systems Laboratory (Spring 2019, Spring 2020, Spring 2022)
  – Supervised laboratory sessions and graded students' assignments
- ME461 - Mechanical Vibrations (Fall 2020)
  – Graded students' assignments and assisted with teaching materials
- ME422 - Introduction to Combustion - (Fall 2019)
  – Graded students' assignments
- ME416 - Computer Assisted Design of Thermal Systems - (Fall 2019)
  – Graded students' assignments

PUBLICATIONS

Journal Papers

- **M. C. Yesilli**, J. Chen, F. A. Khasawneh and Y. Guo, "Automated Surface Texture Analysis via Discrete Cosine Transform and Discrete Wavelet Transform," 2022, arXiv:2204.05968 (*Accepted for publication in Precision Engineering*)
- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, "Chatter Detection in Turning Using Machine Learning and Similarity Measures of Time Series via Dynamic Time Warping," 2022 https://doi.org/10.1016/j.jmapro.2022.03.009
- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, "Topological feature vectors for chatter detection in turning processes" *The International Journal of Advanced Manufacturing Technology,* 2022, https://doi.org/10.1007/s00170-021-08242-5
- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, "On transfer learning for chatter detection in turning using wavelet packet transform and ensemble empirical mode decomposition,"*CIRP Journal of Manufacturing Science and Technology,* 2019, https://doi.org/10.1016/j.cirpj.2019.11.003

Preprints

- **M. C. Yesilli**, R. Khawarizmi, P. Kwon, F. A. Khasawneh,"Tool Wear Identification Using Persistent Homology and Machine Learning," 2022 (*In submission*)
- **M. C. Yesilli**, F. A. Khasawneh, B. P. Mann, "Transfer Learning for Autonomous Chatter Detection in Machining," 2021. (*Under review*)
- A. Myers, **M. C. Yesilli**, F. A. Khasawneh, "On Time Series Methods for Chaos Detection: Application to Large Scale Double Pendulum Simulation," 2021 (*Under Review*)

Conference Papers

- **M. C. Yesilli**, M. Chumley, J. Chen, F. A. Khasawneh and Y. Guo, "Exploring Surface Texture Quantification in Piezo Vibration Striking Treatment (PVST) Using Topological Measures. In International Manufacturing Science and Engineering Conference", MSEC2022. (*Accepted*)
- **M. C. Yesilli** and F. A. Khasawneh "Data-driven and Automatic Surface Texture Analysis Using Persistent Homology," In 2021 *20th IEEE International Conference on Machine Learning and Applications,* IEEE, https://doi.org/10.1109/ICMLA52953.2021.00219
- **M.C., Yesilli**, F. A. Khasawneh, "Data-driven Model Identification for a Chaotic Pendulum with Variable Interaction Potential". IDETC 2020, https://doi.org/10.1115/DETC2020-22597
- **M. C. Yesilli**, F. A. Khasawneh, "On Transfer Learning of Traditional Frequency and Time Domain Features In Turning," *15th International Manufacturing Science and Engineering Conference,* MSEC 2020. https://doi.org/10.1115/MSEC2020-8274
- **M. C. Yesilli**, S. Tymochko, F. A. Khasawneh, E. Munch, "Chatter Diagnosis in Milling Using Supervised Learning and Topological Features Vector," In 2019 *18th IEEE International Conference on Machine Learning and Applications,* IEEE, https://doi.org/10.1109/ICMLA.2019.00200
- J. R. Tempelman, A. Myers, **M. C. Yesilli**, "Experimental Investigations Into Broadband Vibration of Metastructures with Lattice Designs," In *Proceedings of the ASME International Design Engineering Technical Conferences and Computers and Information in Engineering Conference,* IDETC2019, https://doi.org/10.1115/DETC2019-97673

PRESENTED WORK

Contributed Talks

- **Data-driven and Automatic Surface Texture Analysis Using Persistent Homology**, ICMLA 2021, December 2021
- **Chatter Detection in Turning Using Dynamic Time Warping and Approximate and Eliminate Search Algorithm**, SIAM Conference on Applications of Dynamical Systems, May 2021
- **On Transfer Learning of Traditional Frequency and Time Domain Features In Turning**, MSEC2020 (Virtual Conference), September 2020
- **Data-driven Model Identification for a Chaotic Pendulum with Variable Interaction Potential**, IDETC/MSNDC (Virtual Conference), August 2020
- **Chatter Classification and Transfer Learning in Turning Using Topological Data Analysis and Dynamic Time Warping**, MSU TDA Seminar, April 2020
- **Topological Feature Vectors for Chatter Detection in Turning Processes**, The 1st Midwest Graduate Student Conference: Geometry and Topology meet Data Analysis and Machine Learning, June 2019
- **Topological Feature Vectors for Chatter Detection in Turning Processes**, SIAM Conference on Applications of Dynamical Systems, May 2019
- **Chatter diagnosis in turning using Topological Data Analysis**, SIAM Great Lakes Section Meeting, April 2019

Poster

- A.D. Myers, **M.C. Yesilli**, S. Tymochko, F. Khasawneh and E. Munch, "Teaspoon: A comprehensive python package for topological signal processing." *Topological Data Analysis and Beyond Workshop at NeurIPS 2020.*

CODE AND DATA REPOSITORIES

- **M. C. Yesilli**, and F. A. Khasawneh (2022), "Persistence Diagram Computation Using Bezier Curves", Github repository.
- **M. C. Yesilli**, and F. A. Khasawneh (2022), "Topological Saliency Library for Python Using TTK and VTK", Github repository.
- A. Myers, **M. C. Yesilli**, S. Tymochko, F. A. Khasawneh and E. Munch, (2020), Teaspoon: A Topological Signal Processing Package, pypi/teaspoon.
- N. Mork, **M. C. Yesilli**, F. A. Khasawneh, (2020). Design of chaotic pendulum with a variable interaction potential, Zenodo, DOI: 10.5281/zenodo.3784897
- F. A. Khasawneh, A. Otto and **M. C. Yesilli**, (2019), "Turning Dataset for Chatter Diagnosis Using Machine Learning", Mendeley Data, v1, `http://dx.doi.org/10.17632/hvm4wh3jzx.1`
- **M. C. Yesilli**, F. A. Khasawneh, and A. Otto, (2019), "Machine Learning Toolbox for Machining", Github repository.

CONFERENCE ACTIVITIES

- **Minisymposium Co-organizer**, *Topological Signal Processing,* SIAM Conference on Applications of Dynamical Systems, May 2021
- **Minisymposium Co-organizer**, *Topological Time Series Analysis,* SIAM Conference on Mathematics of Data Science, May 2020 *(canceled due to COVID-19)*
- **Session Chair**, SIAM Conference on Applications of Dynamical Systems, May 2021
- **Session Chair**, SIAM Conference on Applications of Dynamical Systems, May 2019

SERVICE

- **Reviewer**, Journal of Intelligent Manufacturing — July 2021
- **Reviewer**, Journal of Intelligent Manufacturing — May 2021
- **Reviewer**, SoftwareX — February 2021
- **Reviewer**, Journal of Ambient Intelligence and Humanized Computing — September 2020
- **Reviewer**, Measurement — June 2020

PROFESSIONAL AFFILIATIONS & ORGANIZATIONS

- **Member**, Association for Computing Machinery (ACM) — March 2021 – March 2022
- **Member**, American Society of Mechanical Engineers (ASME) — October 2019 – October 2021
- **Event Coordinator**, Michigan State University Turkish Student Association (MSU-TSA) — June 2021 – February 2022
- **Treasurer**, Michigan State University Turkish Student Association (MSU-TSA) — April 2019 – June 2021
- **Member**, Society for Industrial and Applied Mathematics (SIAM) — November 2018 – present

LEADERSHIP

Graduate Student Mentor for ACRES-REU — May 2021 – July 2021

- Co-mentored two undergraduate students who participate in Advanced Computational Research Experience for Undergraduates (ACRES-REU)
- Met with students once a week, provided them with guidance on their research, and answered their questions whenever needed

AWARDS

- MSU Graduate Office Fellowship ($5400) — October 2021
- Student Travel Award - SIAM DS21 — May 2021
- MSU Graduate Office Fellowship ($5000) — February 2020
- Sabanci Foundation Scholarship — October 2013 - June 2018

TECHNICAL STRENGTHS

Programming: Python, MATLAB, Julia, C/C++, OpenMP, MPI
Software & Tools: High Perfomance Computing, Sphinx, LaTeX, Solidworks, Inkscape, Arduino