Nil Zeynep Gurel

Ph.D. Candidate in Electrical and Computer Engineering, Georgia Institute of Technology
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Research Interests

physiological modulation • physiological monitoring • active sensing • medical devices • wearables • bio-inspired sensing

Specifically, I am interested in the intersection of biomedical instrumentation, signal processing, and machine learning with focus on mood and performance improvement.

Educational Background

'16-'20 (expected) GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, GA
Ph.D. Candidate in Electrical and Computer Engineering
Minor in Biomedical Engineering
Dissertation: *Real-time Physiological Biomarkers of Noninvasive Vagus Nerve Stimulation for Acute Stress*
ADVISOR : Omer T. Inan; COMMITTEE : Omer T. Inan, Robert Butera, J. Douglas Bremner, Javier Hernandez, and Hua Wang

'14-'16 UNIVERSITY OF MARYLAND, College Park, MD
M.Sc. in Electrical and Computer Engineering
Thesis: *Frequency Domain Characterization of Optic Flow and Vision-based Ocellar Sensing for Rotational Motion*
ADVISORS :Timothy Horiuchi (UMD) and Sean Humbert (UC Boulder)
COMMITTEE : Timothy Horiuchi, Robert W. Newcomb, and Pamela Abshire

'10-'14 BOGAZICI UNIVERSITY, Istanbul, TR (highest honors)
B.Sc. in Electrical and Electronics Engineering

'12-'13 UNIVERSITY OF WASHINGTON, Seattle, WA (highest honors)
Exchange Student in Electrical Engineering

Honors, Awards & Fellowships

'19 iREDEFINE Workshop Travel Award, Georgia Tech

'18 Named one of the Rising Stars in EECS, MIT

'18 Finalist in IEEE EMBC Student Paper Competition [DOI]

'18 Runner-up Best Paper Award in IEEE BSN Best Paper Competition [DOI]

'18 IEEE BSN & BHI Travel Award

'18 iREDEFINE ECE Professional Development Award, NSF

'17 Best Poster Award, NextFlex Flexible Hybrid Electronics Workshop

'17 2018FLEX Travel Award

'16 Molecular Tri-Med Conference, Personal Diagnostics Travel Award

'15 Teaching Assistant Training and Development Fellowship, UMD

'14-'15 Clark School of Engineering Distinguished Graduate Fellowship, UMD

Research Experience

'16-Present Ph.D. Student and Graduate Research Assistant, Inan Research Laboratory

Research on non-invasive wearable sensing and actuation as applied to physiological monitoring and modulation. Received two paper awards, one poster award, and three professional awards for individual and/or combination of projects. Notable projects:

• Closed-loop noninvasive vagal nerve stimulation • Instrumented headband for mental stress quantification
• Soft thermal modulation system for neurovascular assessment • Instrumented bed & kitchen scale for rodents
• Noninvasive autonomic nervous system quantification

'15-'16 Graduate Research Assistant, Autonomous Vehicle Laboratory

• Bio-inspired sensing for micro-aerial vehicles: Designed a multimodal system to quantify rotational motion based on optic flow (digital) and luminance-based ocellar (analog) sensing. Characterized both sensing modalities to compare for fast visual processing in response to sudden disturbances, as desired for drones.

Teaching Experience

Fall '19 Guest Lecturer (to be), *Biomedical Instrumentation [ECE4781]*, Georgia Institute of Technology

Will conduct lectures on biomedical circuits and systems, instrumentation amplifiers, active filters, and wearable sensing.

Spring '19 Guest Lecturer, *Biosystems Analysis [ECE4782]*, Georgia Institute of Technology

Conducted a workshop on feature extraction, feature engineering, dimensionality reduction, and machine learning.

Fall '14 Graduate Teaching Assistant for *Analog and Digital Electronics [ENEE303]*, University of Maryland

Prepared and lectured weekly recitations, quizzes, and office hours. Received teaching fellowship, evaluated per student feedback.

Publications

Journals in preparation

NZ Gurel, MT Wittbrodt, JD Bremner, OT Inan, et al., "Novel Methods for Automatically Detecting Target Engagement in Non-invasive Vagal Nerve Stimulation Using Peripheral Cardiovascular and Autonomic Signal Features", *in preparation for an IEEE journal*, 2019

NZ Gurel, MT Wittbrodt, JD Bremner, OT Inan, et al., "Posttraumatic Stress Disorder Diagnosis using Wearables", *in preparation for an IEEE journal*, 2019

NZ Gurel, B Nevius, D Ward, FL Hammond, et al., "Isolation of Local Thermoregulation Effects from Sympathetic Arousal with a Soft, Wearable Pad using Closed-loop Temperature Control", *in preparation for an IEEE journal*, 2019

Journal articles

NZ Gurel, M Huang, MT Wittbrodt, H Jung, et al., "Quantifying Acute Physiological Biomarkers of Non-invasive Vagus Nerve Stimulation in the Context of Psychological Stress", *under review in a clinical journal*, 2019

NZ Gurel, AM Carek, OT Inan, O Levantsevych, et al., "Comparison of Autonomic Stress Reactivity in Young Healthy versus Aging Subjects with Heart Disease", *minor revision, clinical journal*, 2019

NZ Gurel*, H Jung*, S Hersek, OT Inan, "Fusing Near-Infrared Spectroscopy with Wearable Hemodynamic Measurements Improves Classification of Mental Stress", *IEEE Sensors Journal*, 2018

JD Bremner, MT Wittbrodt, **NZ Gurel**, MH Shandhi, et al., "Application of Non-Invasive Vagal Nerve Stimulation to Stress-related Psychiatric Disorders", *under review in a clinical journal*, 2019

JD Bremner, MT Wittbrodt, AJ Shah, **NZ Gurel**, et al., "Confederates in the Attic: Posttraumatic Stress Disorder, Cardiovascular Disease, and the Return of Soldier's Heart", *under review in a clinical journal*, 2019

AO Bicen, **NZ Gurel**, A Dorier, OT Inan, "Improved Pre-ejection Period Estimation from Ballistocardiogram and Electrocardiogram Signals by Fusing Multiple Timing Interval Features", *IEEE Sensors Journal, 17(13), pp. 4172-4180*, 2017

Peer-reviewed conference proceedings, abstracts, live demos

NZ Gurel*, AH Gazi*, KL Scott, MT Wittbrodt, et al., "Timing Considerations for Noninvasive Vagal Nerve Stimulation in Clinical Studies", *submitted to a medical informatics symposium*, 2019 [10 pages]

NZ Gurel, MT Wittbrodt, AJ Shah, V Vaccarino, et al., "Noninvasive Vagal Nerve Stimulation Effects on Anger Response", *submitted to the IEEE Conference on Biomedical Health Informatics* (BHI '19), 2019

AH Gazi, **NZ Gurel**, KL Scott, MT Wittbrodt, et al., "Preliminary Modeling of the Kinetics of Photoplethysmogram Changes Following Non-Invasive Vagus Nerve Stimulation", *submitted to the IEEE Conference on Biomedical Health Informatics* (BHI '19), 2019

NZ Gurel, MH Shandhi, JD Bremner, V Vaccarino, et al., "Toward Closed-loop Transcutaneous Vagus Nerve Stimulation using Peripheral Cardiovascular Physiological Biomarkers: A Proof-of-concept Study", *IEEE Conference on Wearable and Implantable Body Sensor Networks* (BSN '18), Las Vegas, NV, 2018 [oral, Top 10% among accepted papers] [DOI]

Runner-up Best Paper Award

NZ Gurel, H Jeong, HE Kloefkorn, S Hochman, et al., "Unobtrusive Heartbeat Detection from Mice Using Sensors Embedded in the Nest", *IEEE Engineering in Medicine and Biology Conference* (EMBC '18), Honolulu, HI, 2018 [oral,Top 1.5% among accepted papers] [DOI]

Finalist in Student Paper Competition

NZ Gurel*, D Ward*, FL Hammond, OT Inan, "Live Demonstration: A Soft Thermal Modulation System with Embedded Fluid Channels for Neuro-Vascular Assessment", *IEEE Biomedical Circuits and Systems Conference* (BioCAS '18), Cleveland, OH, 2018 [live demo] [DOI]

H Jeong, **NZ Gurel**, HE Kloefkorn, S Hochman, et al., "Performance of Unobtrusive Detection of High Frequency Heart Rate Variability in Mice using an Instrumented Nest", *IEEE Life Sciences Conference* (LSC '18), Montreal, Canada, 2018 [oral]

D Ward*, **NZ Gurel***, OT Inan, FL Hammond, "A Soft Thermal Modulation and Physiological Sensing System for Neuro-Vascular Assessment", *IEEE Conference on Robotics and Biomimetics* (ROBIO '18), Kuala Lumpur, Malaysia, 2018 [oral] [DOI]

NZ Gurel, H Jung, A Hankus, S Ladd, et al., "Toward Wearable Sensing Enabled Closed-Loop Non-invasive Vagus Nerve Stimulation: A Study of Real-Time Physiological Biomarkers", *Neuromodulation Conference and North American Neuromodulation Society Meeting* (NEUROMODEC '18), New York, NY, 2018 [poster], *Brain Stimulation, 12(2), e13, 2019* [abstract] [DOI]

JD Bremner, **NZ Gurel**, MT Wittbrodt, J Nye, et al., "Non-invasive Vagal Nerve Stimulation Paired with Stress Exposure in Posttraumatic Stress Disorder (PTSD)", *Brain Stimulation, 12(2), 438, 2019* [abstract] [DOI]

JD Bremner, MT Wittbrodt, **NZ Gurel**, J Nye, et al., "Brain Correlates of Non-invasive Vagal Nerve Stimulation in Stress", *Neuromodulation Conference and North American Neuromodulation Society Meeting* (NEUROMODEC '18), New York, NY, 2018 [poster], *Brain Stimulation, 12(2), pp. e3-e4, 2019* [abstract] [DOI]

Technical reports & posters

NZ Gurel, J Conroy, T Horiuchi, S Humbert, "Frequency Domain Characterization of Optic Flow and Vision-based Ocellar Sensing for Rotational Motion", *US Army Research Laboratory ARL-TR-7974*, Adelphi, MD, 2017 [technical report] [PDF]

D Ward*, **NZ Gurel***, OT Inan, FL Hammond, "Soft, Fluidic Modulation of Skin Temperature", *NextFlex Flexible Hybrid Electronics Workshop*, Atlanta, GA, 2017
Best Poster Award

Grant Proposal Writing

'19-Present Working on a Fast Track R43/R44 NIH proposal.

'16-Present Preparing the following deliverables for the DARPA Targeted Neuroplasticity Training (TNT) Program: quarterly reports, 6-week progress teleconference materials, and PI meeting materials.

Work Experience

'13-'14 Research and Development Engineer, Techneon, Istanbul, TR

Summer '12 Intern (Defense Systems Technologies), Aselsan, Ankara, TR

Summer '11 Intern (Software Group), IBM Turkey, Istanbul, TR

Media Coverage

Dec '18 Three ECE Students Become Rising Stars in Academia, *Ashlee Gardner, Georgia Tech*

Jun '18 Gurel Invited to Rising Stars Workshop, Takes Part in iREDEFINE, *Jackie Nemeth, Georgia Tech*

Jun '18 Toward Wearable Sensing Enabled Closed-Loop Non-invasive Vagus Nerve Stimulation, *MIT EECS*

Mar '18 Gurel Receives Paper Prize at IEEE BSN Conference, *Jackie Nemeth, Georgia Tech*

Dec '17 Georgia Tech and NextFlex Team-Up to Make the Internet-of-Things More Flexible & Power Efficient, *Christa Ernst, GT Research Horizons*

Invited Talks & Workshops

'19 (TBA) *Novel Technologies for Physiological Modulation and Active Sensing*
Department of Mathematics and Computer Science Seminars, EMORY UNIVERSITY

Fall '16 *Encouraging Critical Thinking in Classroom*
Workshop for teaching Assistants, UNIVERSITY OF MARYLAND

Spring '15 *Presentation and Instruction Techniques*
Workshop for teaching Assistants, UNIVERSITY OF MARYLAND

Student Advising & Mentoring

'17-Present GEORGIA INSTITUTE OF TECHNOLOGY: One M.Sc and five Ph.D. students
• K. Scott (Ph.D., ECE, 2019-) • B. Nevius (M.Sc., BME 2018-) • S. Sheikh (Ph.D., ECE, 2018-) • A. Gazi (Ph.D., ECE, 2018-2019)
• H. Jung (Ph.D., ECE, 2017-2018) • D. Ward (M.Sc., MechE, 2017-2018, currently pursuing Ph.D.)

'15-'16 UNIVERSITY OF MARYLAND: 13 undergraduates from diverse backgrounds from Gemstone Honors Program with Robert W. Newcomb. The

team completed an interdisciplinary project on a proof-of-concept stationless bikeshare for the campus, eliminating the use of docking stations.

Professional Activities

Apr 1-2, '19 Digital Clinical Trials Workshop (Co-organizer), National Institutes of Health, Bethesda, MD

Reviewer of the articles in the following journals and conferences:

- IEEE Journal on Biomedical Health Informatics (IEEE JBHI) (2016-Present)
- 2019 IEEE International Conference on Biomedical Health Informatics (BHI '19)
- Computers in Biology and Medicine (2016-Present)
- ACM Transactions on Applied Perception (ACM TAP)
- 2019 International Conference on Biological Information and Biomedical Engineering (BIBE 2019)
- IEEE Transactions on Circuits and Systems II (IEEE TCAS-II) (2015-2017)
- 2016 IEEE International Symposium on Circuits and Systems (ISCAS 2016)