

Nil Zeynep Gurel

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

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Research Interests

• wearables • medical devices • active sensing • physiological modulation • physiological monitoring • 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) Ph.D. Candidate in Electrical and Computer Engineering, GEORGIA INSTITUTE OF TECHNOLOGY, Atlanta, GA
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 M.Sc. in Electrical and Computer Engineering, UNIVERSITY OF MARYLAND, College Park, MD
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 B.Sc. in Electrical and Electronics Engineering, BOGAZICI UNIVERSITY, Istanbul, TR (highest honors)
- '12-'13 Exchange Studies in Electrical Engineering, UNIVERSITY OF WASHINGTON, Seattle, WA (highest honors)

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

Publications

Journals in preparation

- [1] 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
- [2] NZ Gurel, MT Wittbrodt, JD Bremner, OT Inan, et al., “Posttraumatic Stress Disorder Diagnosis using Wearables”, *in preparation for an IEEE journal*, 2019
- [3] 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

- [4] 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
- [5] 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
- [6] 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
- [7] 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
- [8] 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
- [9] 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

- [10] 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]
- [11] NZ Gurel, MT Wittbrodt, AJ Shah, V Vaccarino, et al., “Noninvasive Vagal Nerve Stimulation Effects on Anger Response”, *IEEE Conference on Biomedical Health Informatics (BHI ’19)*, Chicago, IL, 2019 [1-page extended abstract]
- [12] AH Gazi, NZ Gurel, KL Scott, MT Wittbrodt, et al., “Preliminary Modeling of the Kinetics of Photoplethysmogram Changes Following Non-Invasive Vagus Nerve Stimulation”, *IEEE Conference on Biomedical Health Informatics (BHI ’19)*, Chicago, IL, 2019 [1-page extended abstract]
- [13] 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**
- [14] 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**
- [15] 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]
- [16] 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]
- [17] 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]
- [18] 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]
- [19] 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]
- [20] 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

- [21] 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]
- [22] 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

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.
- Spr '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.

Proposal Development Experience

- '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, six-week progress teleconference materials, and PI meeting materials.

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*

Work Experience

- '13-'14 Research and Development Engineer, Techneon, Istanbul, TR
- Sum '12 Intern (Defense Systems Technologies), Aselsan, Ankara, TR

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

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
- Spr '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, 2018-2019)
• 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: A team of 13 undergraduates with 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 '19 Co-organizer of the NSF/NIH DIGITAL CLINICAL TRIALS WORKSHOP: CREATING A VISION FOR THE FUTURE held on the main NIH campus, Bethesda, MD
(BROCHURE) (DAY 1 VIDEOCAST) (DAY 2 VIDEOCAST)
- '15- Present Reviewer of the articles in the following journals and conferences:
• 2019 IEEE International Engineering in Medicine and Biology Conference (EMBC '19)
• 2019 American Medical Informatics Association Annual Symposium (AMIA '19)
• 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) (2017-2018)
• 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)