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

• Research Awards

'19 Runner-up Best Poster Award, IEEE BHI Best Poster Competition

'18 Runner-up Best Paper Award, IEEE BSN Best Paper Competition [doi]

'18 Finalist, IEEE EMBC Student Paper Competition [doi]

'17 Best Poster Award, NextFlex Flexible Hybrid Electronics Workshop

• Professional Awards

'19 iREDEFINE Workshop Award, Georgia Tech

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

'18 iREDEFINE ECE Professional Development Award, NSF

• Conference Travel Awards

'18 IEEE BSN & BHI Travel Award

'17 2018FLEX Travel Award

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

• Fellowships

'15 Teaching Assistant Training and Development Fellowship, UMD

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

Publications

Manuscripts in preparation

[23] **NZ Gurel**, MT Wittbrodt, JD Bremner, OT Inan, et al., *in preparation*, 2019

[22] **NZ Gurel**, MT Wittbrodt, JD Bremner, OT Inan, et al., *in preparation*, 2019

[21] **NZ Gurel**, B Nevius, D Ward, FL Hammond, et al., *in preparation*, 2019

Journal articles

[20] **NZ Gurel**, H Jung, MT Wittbrodt, S Ladd, et al., *under review*, 2019

[19] **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*, 2019

[18] **NZ Gurel**, AM Carek, OT Inan, O Levantsevych, et al., "Comparison of Autonomic Stress Reactivity in Young Healthy versus Aging Subjects with Heart Disease", *PLOS ONE, 14(5): e0216278*, 2019 [DOI]

[17] **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 [DOI]

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

[15] 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*, 2019

[14] 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 [DOI]

Peer-reviewed conference proceedings, abstracts, live demos

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

[12] **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, poster]

[11] 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, poster]

Runner-up Best Poster Award

[10] **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] [DOI]

Runner-up Best Paper Award

[9] **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

[8] **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]

[7] 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]

[6] 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]

[5] **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]

[4] 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]

[3] 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

[2] **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]

[1] 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 applied to physiological monitoring and modulation. Received two paper awards, two poster awards, 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*

Student Advising & Mentoring

'17-Present **Georgia Institute of Technology:** One M.Sc and four Ph.D. students
• K. Scott (Ph.D., ECE, 2019-) • A. Gazi (Ph.D., ECE, 2018-2019) • B. Nevius (M.Sc., BME 2018-) • 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.

Work Experience

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

Sensor circuit design, board assembly test firmware, remote monitoring desktop application, electromagnetic compatibility support, CE certification documentation (93-42-EEC, EN60601-1, IEC 60601-2-24) for an infusion pump system.

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

Designed a controller area network-based communication interface and desktop application for guns used on field.

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

Implemented customer-specified customizations on Java-based IBM Maximo Asset Management software.

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)

Diversity & Outreach

Jun '19 Designed a wearable electronics module for high school students to instill interest in ECE. Lecturer (to be) of two hands-on modules for 40 high school students. Module includes basic circuit design, firmware programming, prototyping components. Info: H.O.T. Days @ Georgia Tech Day Camp

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

Last updated: May 26, 2019