

# 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

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 (GPA:4/4)  
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 (GPA:3.73/4)  
Thesis: *Frequency Domain Characterization of Optic Flow and Vision-based Ocular 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, GPA:3.6/4)
- '12-'13 Exchange Studies in Electrical Engineering, UNIVERSITY OF WASHINGTON, Seattle, WA (highest honors, GPA:3.98/4)

## 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

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

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

## Journal articles

- [21] NZ Gurel, H Jung, MT Wittbrodt, S Ladd, et al., *under review*, 2019
- [20] NZ Gurel, M Huang, MT Wittbrodt, H Jung, et al., *under review*, 2019
- [19] 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]
- [18] 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]
- [17] 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
- [16] 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”, *The Journal of Nervous and Mental Disease*, in press, 2019
- [15] 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

- [14] NZ Gurel\*, AH Gazi\*, KL Scott, MT Wittbrodt, et al., “Timing Considerations for Noninvasive Vagal Nerve Stimulation in Clinical Studies”, *American Medical Informatics Association Annual Symposium (AMIA ’19)*, Washington, DC, 2019 [10 pages, oral]
- [13] 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]
- [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, poster]

### Runner-up Best Poster Award

- [11] Y Jiao, Y Ko, NZ Gurel, A Hankus, et al., “Levels of Pituitary Adenylate Cyclase-activating Polypeptide (PACAP) in Post-traumatic Stress Disorder and Modulatory Effect of Noninvasive Cervical Vagus Nerve Stimulation”, *Neuroscience (SfN ’19)*, submitted, 2019
- [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 Ocular 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 hands-on lecture 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 Phase 1 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-) • 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 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 of two hands-on modules for 39 high school students. Module includes basic circuit design, firmware programming, prototyping.
- (H.O.T. DAYS @ GEORGIA TECH DAY CAMP) (WEEK 1 VIDEO) (WEEK 2 VIDEO)

## Workshops Delivered

- 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