

# 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 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 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 ocular (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]

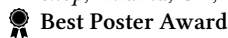
JD Bremner, NZ Gurel, MT Wittbrodt, J Nye, et al., “Non-invasive Vagal Nerve Stimulation Paired with Stress Exposure in Posttraumatic Stress Disorder (PTSD)”, *Brain Stimulation*, 12(2), 438, 2019 [abstract] [doi]

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 Ocular 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](#))