Nil Zeynep Gurel

Ph.D. Candidate in Electrical and Computer Engineering, Georgia Institute of Technology
✉: nil [at] gatech (dot) edu; 🏠: nzgurel.com; ☎: (301) 547-5489; U.S. Permanent Resident

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. in Electrical and Computer Engineering, Georgia Institute of Technology, Atlanta, GA (GPA:4/4)
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, J. Douglas Bremner, Robert Butera, Hua Wang, and Javier Hernandez

'14-'16 M.Sc. in Electrical and Computer Engineering, University of Maryland, College Park, MD (GPA:3.7/4)
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, GPA:3.6/4)

'12-'13 Exchange Studies in Electrical Engineering, University of Washington, Seattle, WA (highest honors, GPA:3.97/4)

Honors, Awards & Fellowships

Research Awards

'19 Runner-up Best Poster, IEEE BHI

'18 Runner-up Best Paper, IEEE BSN [DOI]

'18 Best Paper Finalist, IEEE EMBC [DOI]
(One of the Top 15 papers per reviewer feedback)

'17 Best Poster, NextFlex Flexible Hybrid Electronics Workshop

Professional Awards

'19 Nexus NextProf Future Faculty Workshop Award
(An academic career workshop for diverse leaders in engineering hosted at GT, organized by UC Berkeley, U Michigan, GT)
(One of the 65+ selected participants nationwide from all engineering disciplines with funded accommodation and travel)

'19 iREDEFINE Workshop Award
(An academic career workshop to increase diverse workforce in ECE, hosted in conjunction with ECEDHA Conference)
(One of the two selected participants with GT-funded accommodation and travel)

'18 Rising Stars in EECS
(An academic career workshop for women in EECS, hosted at MIT, organized by MIT, Stanford, Carnegie Mellon)
(One of the 60+ selected participants nationwide and international with funded accommodation and travel)

'18 iREDEFINE ECE Professional Development Award
(One of the 10 selected participants nationwide with NSF-funded accommodation and travel)

Conference Travel Awards

'16-'18 IEEE BSN-BHI'18, IEEE EMBC'18, Molecular Med Tri-Con'16

Fellowships

'15-'16 Teaching Assistant Training and Development Fellowship
(Awarded due to excellent student feedback for teaching by University of Maryland.)

'14-'15 Clark School of Engineering Distinguished Graduate Fellowship (~$70k)

(Admitted as a graduate fellow with tuition remission and stipend to University of Maryland ECE Department.)

Publications

Journal articles

Manuscripts published

[J14] **NZ Gurel**, H Jung, MT Wittbrodt, SL Ladd, AJ Shah, V Vaccarino, JD Bremner, OT Inan, "Automatic Detection of Target Engagement in Transcutaneous Cervical Vagal Nerve Stimulation for Traumatic Stress Triggers", *in press, IEEE Journal of Biomedical and Health Informatics (JBHI),* 2020 [DOI]

[J13] **NZ Gurel**, M Huang, MT Wittbrodt, H Jung, SL Ladd, MH Shandhi, YA Ko, L Shallenberger, JA Nye, BD Pearce, V Vaccarino, AJ Shah, JD Bremner, OT Inan, "Quantifying Acute Physiological Biomarkers of Transcutaneous Cervical Vagal Nerve Stimulation in the Context of Psychological Stress", *Brain Stimulation*, 13(1): 47-59, 2019 [DOI]

[J12] **NZ Gurel**, AM Carek, OT Inan, O Levantsevych, N Abdelhadi, M Hammadah, WT O'Neal, H Kelli, K Wilmot, L Ward, SD Rhodes, BD Pearce, PK Mehta, M Kutner, E Garcia, AA Quyyumi, P Raggi, JD Bremner, AJ Shah, "Comparison of Autonomic Stress Reactivity in Young Healthy versus Aging Subjects with Heart Disease", *PLOS ONE,* 14(5): e0216278, 2019 [DOI]

[J11] **NZ Gurel***, H Jung*, S Hersek, OT Inan, "Fusing Near-Infrared Spectroscopy with Wearable Hemodynamic Measurements Improves Classification of Mental Stress", *IEEE Sensors Journal,* 19(19), pp. 8522-8531, 2018 [*co-first authors] [DOI]

[J10] JD Bremner, MT Wittbrodt, AJ Shah, BD Pearce, **NZ Gurel**, OT Inan, P Raggi, TT Lewis, AA Quyyumi, V Vaccarino, "Confederates in the Attic: Posttraumatic Stress Disorder, Cardiovascular Disease, and the Return of Soldier's Heart", *The Journal of Nervous and Mental Disease,* 208(3):171-180, 2020 [DOI]

[J9] 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]

Manuscripts under review

[J8] **NZ Gurel**, MT Wittbrodt, H Jung, MH Shandhi, EG Stagnaro, SL Ladd, M Huang, YA Ko, L Shallenberger, JA Nye, BD Pearce, V Vaccarino, AJ Shah, OT Inan, JD Bremner, "Transcutaneous Cervical Vagal Nerve Stimulation Blocks Sympathetic Responses in Posttraumatic Stress Disorder", *under review*, 2020 (Submitted in 2019) [preprint]

[J7] MT Wittbrodt, **NZ Gurel**, JA Nye, SL Ladd, AJ Shah, MH Shandhi, M Huang, Z Alam, BD Pearce, N Murrah, YA Ko, L Shallenberger, V Vaccarino, OT Inan, JD Bremner, "Noninvasive Vagal Nerve Stimulation Decreases Brain Activity During Trauma Scripts", *under review*, 2020 (Submitted in 2019)

[J6] AH Gazi, **NZ Gurel**, KL Scott, MT Wittbrodt, AJ Shah, V Vaccarino, JD Bremner, OT Inan, "Modeling Kinetics of Peripheral Cardiovascular Biomarker Responses to Transcutaneous Cervical Vagus Nerve Stimulation", *under review*, 2020 (Submitted in 2019)

[J5] JD Bremner, MT Wittbrodt, **NZ Gurel**, MH Shandhi, MH Rapaport, JA Nye, BD Pearce, V Vaccarino, AJ Shah, J Park, M Bikson, OT Inan, "Application of Noninvasive Vagal Nerve Stimulation to Stress-Related Psychiatric Disorders", *under review*, 2020 (Submitted in 2019)

[J4] Y Jiao, YA Ko, **NZ Gurel**, A Hankus, SL Ladd, MT Wittbrodt, L Shallenberger, N Murrah, M Huang, A Haffer, J Alkhalaf, H Jung, O Levantsevych, JA Nye, MH Shandhi, V Vaccarino, AJ Shah, OT Inan, JD Bremner, BD Pearce, "Levels of Pituitary Adenylate Cyclase-Activating Polypeptide (PACAP) in Traumatic Stress and the Modulatory Effect of Noninvasive Cervical Vagus Nerve Stimulation (nVNS)", *under review*, 2020 (Submitted in 2019)

[J3] JD Bremner, Y Jiao, MT Wittbrodt, **NZ Gurel**, O Levantsevych, M Huang, MH Shandhi, J Beckwith, I Herring, MH Rapaport, EG Stagnaro, YA Ko, J Alkhalaf, M Soudan, J Song, B Ko, L Shallenberger, N Murrah, A Hankus, JA Nye, J Park, V Vaccarino, AJ Shah, OT Inan, BD Pearce, "Noninvasive Vagal Nerve Stimulation Blocks Stress-Induced Activation of Interleukin-6 in Posttraumatic Stress Disorder", *under review*, 2020 (Submitted in 2019)

Manuscripts in preparation

[J2] **NZ Gurel**, MT Wittbrodt, H Jung, MH Shandhi, V Vaccarino, AJ Shah, BD Pearce, JD Bremner, OT Inan, *in preparation*, 2020

[J1] MT Wittbrodt, **NZ Gurel**, H Jung, MH Shandhi, V Vaccarino, AJ Shah, BD Pearce, JD Bremner, OT Inan, *in preparation*, 2020

Book chapters

[B1] MT Wittbrodt, **NZ Gurel**, V Vaccarino, OT Inan, JD Bremner, "Noninvasive Vagus Nerve Stimulation and Stress", Book chapter on the effects of noninvasive cervical vagus nerve stimulation in PTSD and non-PTSD traumatized controls, *submitted*, 2020

Peer-reviewed conference proceedings, abstracts, live demos

[C12] **NZ Gurel***, AH Gazi*, KL Scott, MT Wittbrodt, AJ Shah, V Vaccarino, JD Bremner, OT Inan, "Timing Considerations for Noninvasive Vagal Nerve Stimulation in Clinical Studies", *American Medical Informatics Association Annual Symposium* (AMIA '19), Washington, DC, 2019 [oral, 10-pages, session offering MOC-II credit to practicing clinical informaticians, *co-first authors] [PDF]

[C11] **NZ Gurel**, MT Wittbrodt, AJ Shah, V Vaccarino, OT Inan, JD Bremner, "Noninvasive Vagal Nerve Stimulation Effects on Anger Response", *IEEE Conference on Biomedical Health Informatics* (BHI '19), Chicago, IL, 2019 [poster, 1-page] [PDF]

[C10] AH Gazi, **NZ Gurel**, KL Scott, MT Wittbrodt, AJ Shah, V Vaccarino, JD Bremner, OT Inan, "Preliminary Modeling of the Kinetics of Photoplethysmogram Changes Following Noninvasive Vagus Nerve Stimulation", *IEEE Conference on Biomedical Health Informatics* (BHI '19), Chicago, IL, 2019 [poster, 1-page] [PDF]

Runner-up Best Poster

[C9] Y Jiao, YA Ko, **NZ Gurel**, A Hankus, SL Ladd, MT Wittbrodt, L Shallenberger, N Murrah, M Huang, A Haffer, J Alkhalaf, H Jung, O Levantsevych, JA Nye, MH Shandhi, V Vaccarino, AJ Shah, OT Inan, JD Bremner, BD Pearce, "Levels of Pituitary Adenylate Cyclase-Activating Polypeptide (PACAP) in Posttraumatic Stress Disorder and Modulatory Effect of Noninvasive Cervical Vagus Nerve Stimulation", *Society for Neuroscience* (SfN '19), Chicago, IL, 2019 [poster, 1-page, abstract online]

[C8] **NZ Gurel**, MH Shandhi, JD Bremner, V Vaccarino, SL Ladd, L Shallenberger, AJ Shah, OT Inan, "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, 4-pages, Top 3% among accepted papers] [DOI]

Runner-up Best Paper

[C7] **NZ Gurel**, H Jeong, HE Kloefkorn, S Hochman, OT Inan, "Unobtrusive Heartbeat Detection from Mice Using Sensors Embedded in the Nest", *IEEE Engineering in Medicine and Biology Conference* (EMBC '18), Honolulu, HI, 2018 [oral, 4-pages, Top 15 among the accepted ∼1500 proceedings] [DOI]

Best Paper Finalist

[C6] **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, 1-page, *co-first authors] [DOI]

[C5] H Jeong, **NZ Gurel**, HE Kloefkorn, S Hochman, OT Inan, "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, 4-pages] [PDF]

[C4] 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, 8-pages, *co-first authors] [DOI]

[C3] **NZ Gurel**, H Jung, A Hankus, SL Ladd, MH Shandhi, M Huang, SD Rhodes, L Shallenberger, BD Pearce, AJ Shah, V Vaccarino, OT Inan, JD Bremner, "Toward Wearable Sensing Enabled Closed-Loop Noninvasive 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]

[C2] JD Bremner, **NZ Gurel**, MT Wittbrodt, JA Nye,Z Alam, I Herring, L Shallenberger, A Haffer, O Levantsevych, N Murrah, YA Ko, BD Pearce, MH Shandhi, AJ Shah, V Vaccarino, OT Inan, "Noninvasive Vagal Nerve Stimulation Paired with Stress Exposure in Posttraumatic Stress Disorder", *Brain Stimulation, 12(2), 438, 2019* [abstract] [DOI]

[C1] JD Bremner, MT Wittbrodt, **NZ Gurel**, JA Nye, Z Alam, V Vaccarino, SL Ladd, L Shallenberger, M Huang, YA Ko, BD Pearce, MH Shandhi, AJ Shah, OT Inan, "Brain Correlates of Noninvasive 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

[T2] **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, 60-pages] [PDF]

[T1] D Ward*, **NZ Gurel***, OT Inan, FL Hammond, "Soft, Fluidic Modulation of Skin Temperature", *NextFlex Flexible Hybrid Electronics Workshop*, Atlanta, GA, 2017 [*co-first authors]
Best Poster

Research Experience

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

Research on noninvasive wearable sensing and actuation applied to physiological monitoring and modulation. Received two paper awards, two poster awards, four professional awards, three conference travel awards for individual or combination of projects. Notable projects:

- Physiological biomarkers of cervical noninvasive vagal nerve stimulation in the context of acute stress
- Instrumented headband for mental stressor classification
- 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.

Teaching Experience

Fall '19 — Guest Lecturer, *Biomedical Sensing Systems [ECE4781/8833]*, Georgia Institute of Technology

Conducted lectures on noninvasive peripheral stimulation and wearable sensing.

Spr '19 — Guest Lecturer, *Biosystems Analysis [ECE4782/8834]*, Georgia Institute of Technology

Conducted hands-on lectures on feature extraction, feature engineering, dimensionality reduction, and machine learning.

Fall '14 — Graduate Teaching Assistant, *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

'17- Present — Assisted the development of the following proposals:

- NIH NIDA UG3/UH3 (successful, "nVNS in Patients with Opioid Use Disorders", 2020-2025, UG3 Phase: $460k, UH3 Phase: $3.9M, PIs: JD Bremner, OT Inan)
- DARPA ElectRx (successful, "Multi-Modal Sensing Enabled Closed-Loop tVNS for Musculoskeletal Injury and Disorders", 2019-2021, Phase 1: $694k, Phase 2: $577k, PIs: OT Inan, M Etemadi)
- one NSF SCH (submitted, PI: OT Inan), two NIH R01s (submitted, PIs: I Hajjar, JD Bremner, OT Inan), one Alzheimer's Association (submitted, PI: I Hajjar), one NIH R01 (in preparation)

'16-'20 — Prepared the following deliverables for the DARPA Targeted Neuroplasticity Training (TNT) Program: quarterly reports, six-week progress teleconference materials, and PI meeting materials. Attended conference calls for all progress materials for communication of research with program officers.

Media Coverage

Dec '19 — ECEDHA and iREDEFINE: Bringing Together Academia and Industry, *Leslie Prives, IEEE Women in Engineering Magazine, 13(2): 28-33*

Aug '19 Gurel Chosen for NextProf Nexus Workshop, *Jackie Nemeth, Georgia Tech*

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 Noninvasive 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 2018-2019) • 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 a proof-of-concept prototype for stationless bikeshare for the campus.

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:
• IEEE Journal of Biomedical Health Informatics (IEEE JBHI) (2016-Present)
• American Medical Informatics Association Annual Symposium (AMIA '19) (AMIA '20)
• IEEE Transactions on Electron Devices (IEEE T-ED) (2019)
• IEEE International Engineering in Medicine and Biology Conference (EMBC '19)
• IEEE International Conference on Biomedical Health Informatics (BHI '19)
• Computers in Biology and Medicine (2016-2019)
• ACM Transactions on Applied Perception (ACM TAP) (2017-2018)
• International Conference on Biological Information and Biomedical Engineering (BIBE '19)
• IEEE Transactions on Circuits and Systems II (IEEE TCAS-II) (2015-2017)
• IEEE International Symposium on Circuits and Systems (ISCAS '16)

Diversity & Outreach

Nov '19 Reviewer for the Posters at the Georgia State Capitol showcase of research and creative projects by undergraduate students from universities in the state of Georgia. During the event, students present their projects to those responsible for crafting higher education policy in Georgia.

Oct '19 Volunteer for the Young Guru Academy (YGA) of Turkey to give hands-on lectures to introduce Twin Science Kits to the primary school students in underprivileged areas of Georgia to promote diversity and inclusion in STEM.

Aug '19 ECE Rush Volunteer: presented opportunities on research for bioengineering technical interest group for transfer students, undecided majors, ECE freshmen.

Jun '19 H.O.T. Days @ Georgia Tech Day Camp Lecturer: 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. (Week 1 Video) (Week 2 Video)

Invited Talks & Workshops

"Coping with Trauma: Noninvasive Vagal Nerve Stimulation for Acute Stress and Its Real Time Biomarkers in PTSD"

Apr '20 University of California, Los Angeles, CA, Neurocardiology Center for Excellence

Apr '20 Stony Brook University, Stony Brook, NY, School of Medicine and College of Engineering & Applied Sciences

Mar '20 Cornell Tech and Cornell University, New York City and Ithaca, NY, Department of Electrical and Computer Engineering

Mar '20 University of Maryland, College Park, MD, Department of Electrical and Computer Engineering

Nov '19 National Institutes of Mental Health, Bethesda, MD, Non-invasive Neuromodulation Unit

Fall '16 *Encouraging Critical Thinking in Classroom*
Workshop for graduate teaching assistants, University of Maryland

Spr '15 *Presentation and Instruction Techniques*
Workshop for graduate teaching assistants, University of Maryland

References

Omer T. Inan, PhD
Associate Professor, School of Electrical and Computer Engineering
Adjunct Associate Professor, Coulter Department of Biomedical Engineering
Georgia Institute of Technology, Atlanta, GA
✉: omer.inan@ece.gatech.edu

J. Douglas Bremner, MD
Professor, Psychiatry and Behavioral Sciences and Radiology, Emory School of Medicine
Director, Mental Health Research, Atlanta VA Medical Center, Decatur, GA
✉: doug.bremner@emory.edu

Mozziyar Etemadi, MD, PhD
Research Assistant Professor, Department of Biomedical Engineering, McCormick School of Engineering
Research Assistant Professor, Department of Anesthesiology, Feinberg School of Medicine
Northwestern University, Chicago, IL
✉: mozzi@northwestern.edu

Robert J. Butera, PhD
Professor, School of Electrical and Computer Engineering
Professor, Coulter Department of Biomedical Engineering
Georgia Institute of Technology, Atlanta, GA
✉: rbutera@gatech.edu

Hua Wang, PhD
Associate Professor, School of Electrical and Computer Engineering
Georgia Institute of Technology, Atlanta, GA
✉: hua.wang@ece.gatech.edu

Last updated: April 8, 2020