Onur Selim KILIC

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Machine-learning researcher in generative modeling and time-series analysis for biomedical and wearable sensing. Builds flow-based generative models and physics-informed neural networks that translate and denoise physiological signals across sensor configurations while preserving phase and morphology, validated on real-world clinical datasets rather than benchmarks alone. Focused on turning signal-processing theory into ML systems robust enough to deploy.

Education

Dec 22 - Present | **Ph.D. in Electrical and Computer Engineering** — ***Georgia Tech, Inan Research Lab***
Specialization Area: Machine Learning, Biomedical Signal Processing | Advisor: Prof. Dr. Omer T. Inan

Oct 20 - Aug 22 | **M.S. in Electrical and Electronics Engineering** — ***METU Center for Image Analysis***
Thesis: Utilization of Event-based Cameras for Video Frame Interpolation | Advisor: Prof. Dr. Aydin ALATAN

Oct 17 - Jul 21 | **B.S. in Mathematics (Double Major)** — ***METU MATH***
Graduated as a High Honor Student

Oct 16 - Jul 20 | **B.S. in Electrical and Electronics Engineering** — ***METU EEE***
Specialization Area: Signal Processing and Communications | Graduated as a High Honor Student

Work Experience

May 26 - Aug 26 | **Data Science Intern** — ***Cardiosense Inc., Chicago, IL, USA***
- Developed reconstruction and representation learning methods for instance level signal quality assessment, using cross modal physiological signal reconstruction and latent features to identify informative windows and improve the reliability of subject level PCWP estimation.
- Curated, validated, and processed a large scale multimodal clinical waveform dataset containing millions of signal windows, resolving inconsistencies across database, cloud storage, and preprocessing pipelines while preparing the data for foundation model training on cloud compute infrastructure.

Jun 23 - Nov 25 | **Research Engineer** — ***MetaDialog, Dubai, UAE***
- Developed an automated Python framework integrating large language models (Anthropic Claude 3.7) and vector embeddings to systematically translate complex, multimodal guideline documents into structured, executable decision graphs, leveraging asynchronous processing, duplication detection, and graph optimization for scalable document parsing and visual analytics.
- Developed an OpenAI GPT-4-driven agent capable of interpreting natural-language queries, autonomously generating and refining executable Python scripts, and dynamically retrieving relevant database content via semantic embeddings.
- Developed an OpenAI GPT-3.5 data extraction agent to intelligently parse structured and unstructured datasets according to dynamic user specifications, implementing systematic workflows for robust information retrieval, precise output validation, and context-aware documentation.

Dec 22 - Present | **Graduate Research Assistant** — ***Inan Research Lab, Atlanta, GA***
- Design, setup, and execution of laboratory and clinical physiological sensing studies, including recruitment, IRB protocol management, and multimodal data collection for stress response, respiratory regulation, and underwater cardiovascular monitoring studies.
- Development of signal processing and machine learning methods, including flow matching generative models, physics-informed neural networks, instantaneous phase estimation, and event detection based on Kalman filtering, for denoising, transforming, and extracting clinically relevant features from physiological signals.
- Mentorship of numerous graduate and undergraduate students on signal processing and machine learning components of ongoing research projects.

Sep 20 - Jun 22 | **Scientific Project Specialist** — ***METU Center for Image Analysis, Ankara, Turkey***
*Designed and developed a cognitive real-time camera system to enhance face recognition quality in a project granted by The Republic of Turkey Presidency of Defense Industries. Face detection, object tracking, and background subtraction algorithms were utilized within the project's scope using different camera models of HiSilicon. Using **C++**, these embedded systems are designed to give feedback through their pipelines utilizing a multi-threaded procedure.*

Jun 19 - Sep 19 | **Intern** — ***HAVELSAN, Ankara, Turkey***
Proposed and developed an object detection and segmentation algorithm which was based on Mask R-CNN and ResUNET using Python.

Jun 18 - Sep 18 | **Intern** — ***ESEN System, Ankara, Turkey***
Designed and developed a benchmark pedestrian detection algorithm using Support Vector Machines (SVMs). Developed a graphical user interface for wide-area surveillance using MATLAB.

Publications

Journal Articles

Preprint

[J1] Aug 26 | **The Stabilized Hilbert Transform: Local Phase Repair for Robust Instantaneous Phase Estimation in Physiological Signals**
***Onur Selim Kilic**, Afra Nawar, Cem Okan Yaldiz, Amit J. Shah, and Omer T. Inan*
Under review at Computers in Biology and Medicine

[J2] Sep 26

Signal-Quality-Aware Fusion of Physiological Foundation Models for Low Cardiac Output Syndrome Detection After Congenital Heart Disease Surgery

Ahmet Rasim Emirdagi, Zeineb Bouzid, Cem Okan Yaldiz, Darpit Dave, Shruti Jeyaraman, Hyonyoung Shin, Jeffrey Liu, ***Onur Selim Kilic****, Izzet T. Akbasli, Orkun Baloglu, Anirudha Das, Kristopher Kormos, Bradley S. Marino, Catherine K. Allan, Hani Najm, Nanshu Lu, Omer T. Inan, and Animesh Tandon*

Under review at Nature Communications

[J3] Jul 26

Characterizing Heterogeneous Lower-Limb Health States in Collegiate Athletes Using Multimodal Wearable Sensing

Holland E. Ernst, Ahmet Rasim Emirdag, Vikram Abbaraju, Cem O. Yaldiz, ***Onur Selim Kilic****, Samer Mabrouk, Emma Hixenbaugh, Brian Hack, Abbey Green, Christopher J. Nichols, Quentin Goossens, Aprameya Satish, Brian King, Mindy Millard-Stafford, Alessio Medda, and Omer T. Inan*

Under review at npj Digital Medicine

[J4] May 26

Multi-Task Learning Based Estimation of Hemodynamic Parameters from Cardiovascular Signals Measured with a Wearable Device during Hemorrhage

Demet Tangolar, Cem O. Yaldiz, Sina Masoumi Shahrbabak, Yuanyuan Zhou, ***Onur Selim Kilic****, Gabriela I. Cestero, Parham Rezaei, John Vandenberge, Nancy Kim, Carl A. Johnson Jr., Douglas Tran, Randy Perez, Donghyeon Kim, Nicholas Burch, Rishwanth Vetri, Zeineb Bouzid, Rayan Bahrami, Zhongjun J. Wu, Jin-Oh Hahn, and Omer T. Inan*

Under review at ACM Transactions on Computing for Healthcare

[J5] May 26

Multi-Modal Self-Supervised Learning of Signal Dynamics Enables Scalable Blood Volume Assessment in Hypovolemia

Cem O. Yaldiz, Demet Tangolar, ***Onur Selim Kilic****, Afra Nawar, Ahmet Rasim Emirdagi, Gabriela I. Cestero, Zeineb Bouzid, Harish K. Haresamudram, Zhongjun J. Wu, Thomas Ploetz, Jin-Oh Hahn, and Omer T. Inan*

Under review at IEEE Transactions on Biomedical Engineering

[J6] Apr 26

Automated Detection of Abnormal Stress-Induced Blood Pressure Reactivity in Post–Myocardial–Infarction Individuals Using Multimodal Wearable Signals

Afra Nawar, ***Onur Selim Kilic****, Cem O. Yaldiz, Farhan N. Rahman, George Haddad, Lewam Stefanos, Tatum Roberts, Jeffery Osei, Kara Suvada, Abdulkareem Murtala, Lucy Shallenberger, Arshed Quyyumi, Kasra Moazzami, Viola Vaccarino, Omer T. Inan, and Amit J. Shah*

Under review at ACM Transactions on Computing for Healthcare

[J7] Apr 26

Deep Learning Framework for Seismocardiography Signal Quality Classification with Cross-Species Few-Shot Transfer Learning

Michael J. Cho, ***Onur Selim Kilic****, Cem O. Yaldiz, Vikram Abbaraju, Afra Nawar, Ahmet Rasim Emirdagi, Demet Tangolar, Farhan N. Rahman, Gabriela I. Cestero, Maako Fangajei, Zeineb Bouzid, and Omer T. Inan*

Under review at ACM Transactions on Computing for Healthcare

Published & Accepted

[J8] Dec 25

KneeMS to Monitor Knee Acoustic Emissions for Juvenile Idiopathic Arthritis

Ruchik Mishra, Quentin Goossens, Christopher J. Nichols, Ahmet Rasim Emirdagi, Chuoqi Chen, ***Onur Selim Kilic****, Mohammad Nikbakht, Prabhkirat S. Bindra, Catherine Yang, Cate Garretson, Lori Ponder, Sampath Prahalad, and Omer T. Inan*

IEEE Journal of Translational Engineering in Health and Medicine (JTEHM)

[J9] Nov 25

EffSCG: An Efficient Framework for Real-Time Seismocardiogram Denoising on Resource-Constrained Edge Devices

Ahmet Rasim Emirdagi, Cem O. Yaldiz, ***Onur Selim Kilic****, Michael J. Cho, and Omer T. Inan*

IEEE Journal of Biomedical and Health Informatics

[J10] Oct 25

Establishing Generalizability of Wearable-Enabled Blood Volume Decompensation Status Estimation Algorithms Using Transfer Learning *Paper*

Demet Tangolar, Zeineb Bouzid, Cem O. Yaldiz, ***Onur Selim Kilic****, Jacob P. Kimball, Parham Rezaei, Sina Masoumi Shahrbabak, John Vandenberge, Yuanyuan Zhou, Nancy Kim, Douglas Tran, Randy Perez, Donghyeon Kim, Nicholas Burch, Rayan Bahrami, Zhongjun J. Wu, Jin-Oh Hahn, and Omer T. Inan*

Computers in Biology and Medicine

[J11] Jul 25

A Robust and Interpretable Deep Transfer Learning Framework on Knee Acoustic Emissions for Osteoarthritis Classification *Paper*

Onur Selim Kilic*, Ahmet Rasim Emirdagi*, Christopher J. Nichols, Quentin Goossens, Dave Ewart, and Omer T. Inan*

npj Biomedical Innovations

[J12] Jun 25

SCG-PHD: Seismocardiography Pig Hypovolemia Dataset for Signal Quality Indexing and Validated Cardiac Timings *Paper*

Michael J. Cho, Cem O. Yaldiz, Afra Nawar, Vikram Abbaraju, Ryan C. Emadi, ***Onur Selim Kilic****, Zeineb Bouzid, Farhan N. Rahman, Chuoqi Chen, Jacob M. Cook, Ahmet Rasim Emirdagi, Roshan L. Saigal, Mickey Paulus, and Omer T. Inan*

Nature Scientific Data

[J13] May 25

A Wearable Closed-Loop System for Acute Stress Monitoring and Mitigation through Transcutaneous Median Nerve Stimulation *Paper*

Farhan N. Rahman, Prabhkirat S. Bindra, Afra Nawar, H. Trask Crane, Jésus Antonio Sánchez-Pérez, John A. Berkebile, ***Onur Selim Kilic****, Chuoqi Chen, Vikram Abbaraju, Christopher J. Nichols, Jacob M. Cook, Samer Mabrouk, Asim H. Gazi, Jin-Oh Hahn, and Omer T. Inan*

Biosensors and Bioelectronics

[J14] May 25

Life-Vest Embedded Ballistocardiogram Measurement System for Underwater Heart Rate and Heart Rate Variability Monitoring *Paper*

Chuoqi Chen, Zeineb Bouzid, Gabriela I. Cestero, Jacob M. Cook, Mohammad Nikbakht, Nicholas Y. Harris, Afra Nawar, ***Onur Selim Kilic****, Jin-Oh Hahn, and Omer T. Inan*

IEEE Sensors Journal

[J15] Feb 25

Elucidating the Reactivity of Reflectance-Based Core Body Photoplethysmogram to Posture and Respiratory Changes *Paper*

Afra Nawar, ***Onur Selim Kilic****, Farhan N. Rahman, Chuoqi Chen, Michael Chan, John A. Berkebile, Amit J. Shah, and Omer T. Inan*

IEEE Sensors Journal

[J16] Feb 25

Heart Rate Informed Detection of Cardiac Events Using the Kalman Filter *Paper*

Onur Selim Kilic*, Afra Nawar, Cem O. Yaldiz, Farhan N. Rahman, Chuoqi Chen, Amit J. Shah and Omer T. Inan*

Computers in Biology and Medicine

Conference Papers

Preprint

[C1] Sep 26

Physics-Constrained Direct Flow Matching: Governing the Source-to-Target Vector Field with a Known Physiological Law

Onur Selim Kilic*, Holland E. Ernst*, Ozgur Kara, James M. Rehg, Amit J. Shah, and Omer T. Inan*

Under review at International Conference on Learning Representations (ICLR) 2027

Published & Accepted

[C2] Aug 26

Implementation and Validation of a Real-Time Algorithm for Wearable Seismocardiogram Fiducial Point Detection

Farhan N. Rahman, Maako Fangajei, Afra Nawar, ***Onur Selim Kilic****, Cem Okan Yaldiz, Jin-Oh Hahn, and Omer T. Inan*

The 25th IEEE Conference on Sensors (IEEE Sensors 2026)

[C3] May 26

Cylindrical Geodesic Flow Matching for Quasiperiodic Physiological Signal Transformation

Onur Selim Kilic*, Afra Nawar, Cem O. Yaldiz, Michael J. Cho, Ahmet Rasim Emirdagi, Demet Tangolar, Amirali Aghazadeh, Amit J. Shah, and Omer T. Inan*

Neural Information Processing Systems (NeurIPS) 2026

[C4] Mar 26

Best Presentation **Guideline2Graph: Profile-Aware Multimodal Parsing for Executable Clinical Decision Graphs** *Paper*

Onur Selim Kilic*, Yeti Z. Gurbuz, Cem O. Yaldiz, Afra Nawar, Etrit Haxholli, Ogul Can, Eli Waxman*

IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) 2026, Medical Reasoning with Vision-Language Foundation Models Workshop

[C5] Jul 25

Time-Delay Invariance of Persistence Diagrams for Seismocardiogram Signal Quality Assessment *Paper*

Afra Nawar, Farhan N. Rahman, ***Onur Selim Kilic****, Amit J. Shah, and Omer T. Inan*

IEEE-EMBS International Conference on Body Sensor Networks (BSN 2025)

[C6] Jun 25

Short-Term Physiological Forecasting with Adaptive Covariance Matrix Estimation *Paper*

Cem O. Yaldiz, ***Onur Selim Kilic****, and Omer T. Inan*

IEEE-EMBS International Conference on Body Sensor Networks (BSN 2025)

[C7] Jun 25

Best Paper **Enabling Intelligent Resuscitation: Non-Invasive Cardiac Output Monitoring via Physiological Sensing and Machine Learning** *Paper*

Demet Tangolar, ***Onur Selim Kilic****, Samuel Liu, Cem O. Yaldiz, Jacob P. Kimball, and Omer T. Inan*

IEEE-EMBS International Conference on Body Sensor Networks (BSN 2025)

[C8] Mar 23

MAEVI: Motion Aware Event-Based Video Frame Interpolation *Paper*

Ahmet Akman, ***Onur Selim Kilic****, and A. Aydin Alatan*

arXiv preprint

[C9] Sep 22

E-VFIA: Event-Based Video Frame Interpolation with Attention *Paper*

Onur Selim Kilic*, Ahmet Akman and A. Aydin Alatan*

IEEE International Conference on Robotics and Automation 2023 (ICRA 2023)

Teaching Experience

Jul 23 - Dec 23 | **Advanced Programming Techniques for Engineering Applications** — ***Georgia Tech ECE4122/6122***
Led weekly C++ recitation sessions and produced/graded programming homework. Topics included MPI-based distributed computing, multithreaded programming, introductory OpenGL graphics, and non-blocking I/O.

May 23 - Jul 23 | **Feedback Control of Dynamic Systems** — ***Georgia Tech ECE3550***
Prepared detailed solution keys and graded all homework sets, quizzes, and examinations. Material covered elementary signal operations, LTI differential-equation modeling, Laplace analysis, transfer-function and stability tools (Bode, Routh–Hurwitz), connection algebra, classical feedback design (root-locus, Nyquist) and selected advanced topics such as delay and discrete-time systems.

Jan 23 - May 23 | **Fundamentals of Machine Learning** — ***Georgia Tech ECE4803/8804***
Held weekly office hours, designed/graded written and coding-based assignments, and created Kaggle competitions that framed course projects. The concepts include supervised/unsupervised learning fundamentals; classification methods (k-NN, logistic regression, etc.); regression with PCA; clustering (k-Means, GMM, spectral) and image segmentation; deep learning with PyTorch-CNNs, autoencoders, VAEs, transfer learning.

Sep 21 - Jan 23 | **Electrical/Electronics Circuits Laboratory** — ***METU EE213 / EE214***
Generated pre-experiment video lectures, managed asynchronous discussion forums, and ran live help sessions. Wrote/maintained experiment manuals and pre-lab assignments; designed and graded weekly quizzes, lab reports, and individual end-term practical exams (including oral questioning). Experimental set covered oscilloscopes & signal generators, resistive networks, op-amp circuits, first-order transients, diodes/rectifiers, transformers, impedance & complex power, frequency-response and active-RC filters, BJT characterization, and basic digital-logic gates.

Mar 21 - Jul 21 | **Signals and System 2** — ***METU EE306***
Served as course–coordinator assistant: authored, graded, and returned feedback on weekly quizzes and ran open Q&A review sessions. Clarified core topics for students including signal correlation, energy / power spectral densities, Hilbert transform–based analytic signals, AM/FM modulation principles, and fundamentals of stochastic processes—stationarity, ergodicity, autocorrelation, power spectral density, noise modeling.

Honors and Awards

2022 | **Georgia Tech ECE Fellowship** — ***Georgia Tech ECE Fellowship Website***
An award given to students with exceptional backgrounds.

2020 | **Bulent Kerim Altay Award** — ***Bulent Kerim Altay Awards Website***
An award given to students who have 4.0 GPA.

2016 - 2020 | **High Honor Student** — ***METU Rules and Regulations Article-30***
Semester high honor student 5 times. A title given to students with a GPA greater than 3.5.

2016 - 2020 | **Tubitak Scholarship** — ***Tubitak 2205-Scholarship Program***
Tubitak scholarship for double major students.

Certificates, Skills & Languages

Certificates: TOEFL iBT 106/120 (10/2021-10/2023)
Utilities: LaTeX, Git , Microsoft Office applications, Ubuntu
Natural: Turkish (Native Speaker), English (Advanced)
Formal: Python, MATLAB, C++, C