

# Fatih Ilhan

## Resume

Department of Electrical and Electronics Engineering  
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RESEARCH INTERESTS	Machine learning, deep learning, forecasting, spatio-temporal prediction, convex/non-convex optimization, online learning, anomaly detection, reinforcement learning, big data, and computer vision.	
EDUCATION	<b>Bilkent University</b> , Ankara, Turkey	September 2019 – Present
	M.Sc. in Electrical and Electronics Engineering, CGPA: <b>3.75 / 4.00</b> Full Scholarship from Bilkent University Thesis Title: Switching based Nonlinear Time Series Prediction in Nonstationary Environments Expected Graduation Date: June 2021	
	<b>Bilkent University</b> , Ankara, Turkey	February 2015 – June 2019
	B.S. in Electrical and Electronics Engineering, CGPA: <b>3.81 / 4.00</b> Comprehensive Full Merit Scholarship based on University Entrance Exam rank High Honor Student at all semesters, undergraduate researcher and part-time data scientist during the senior year Senior Project: 2D outdoor localization system completely independent of GPS. The system uses CDMA and TDOA techniques and provides precise localization ( $\pm 2$ meters) within 6 kilometers.	
	<b>Nagoya University</b> , Nagoya, Japan	April 2018 – August 2018
	Exchange Program in Electrical and Electronics Engineering	
	<b>Ankara Science High School</b> , Ankara, Turkey	September 2010 – June 2014
	High School Degree, Natural Sciences Field, CGPA: <b>95.26 / 100</b>	
AWARDS AND HONORS	<ul style="list-style-type: none"><li>• <b>8 journal papers</b> in highly respected Transactions, including <b>7 IEEE Transactions</b>, 1 accepted with minor revision, 1 successfully passed the second review process, 3 successfully passed the first review process, 3 under review.</li><li>• <b>6 conference papers</b> in high impact conference proceedings.</li><li>• <b>3 patents</b> on real-time spatio-temporal event prediction and anomaly detection with deep learning.</li><li>• <b>13 open-source projects</b> available on GitHub, containing paper implementations and individual projects.</li><li>• Received the <b>191st</b> rank among 2M high school graduates in University Entrance Examination.</li><li>• Received the <b>80th</b> rank among 0.2M university graduates in ALES (National GRE).</li><li>• Full <b>TUBITAK Scholarship</b> for the M.Sc. studies.</li><li>• <b>JASSO Scholarship</b> for Exchange Program at Nagoya University.</li><li>• <b>Full Scholarship</b> from Bilkent University during M.Sc. and Ph.D. Studies.</li><li>• <b>Comprehensive Full Scholarship</b> from Bilkent University during B.S. studies.</li><li>• Bilkent University High Honor Student during B.S. Studies.</li></ul>	

1. **F. Ilhan** and S. S. Kozat, “Modeling of Spatio-Temporal Hawkes Processes with Randomized Kernels”, **IEEE International Transactions on Signal Processing**, 2020.  
(accepted with minor revisions, available on: <https://ieeexplore.ieee.org/document/9177186>)
2. **F. Ilhan**, O. Karaahmetoglu, I. Balaban and S. S. Kozat, “Markovian RNN: An Adaptive Time Series Prediction Network with HMM-based Switching for Nonstationary Environments”, **IEEE Transactions on Neural Networks and Learning Systems**, 2020.  
(passed the first review, available on: <https://arxiv.org/abs/2006.10119>)
3. N. M. Vural, **F. Ilhan**, S. F. Yilmaz and S. S. Kozat, “Achieving Online Regression Performance of LSTMs with Simple RNNs”, **IEEE Transactions on Neural Networks and Learning Systems**, 2020.  
(passed the second review, available on: <https://arxiv.org/abs/2005.08948>)
4. O. Karaahmetoglu, **F. Ilhan** and S. S. Kozat, “Unsupervised Online Anomaly Detection On Irregularly Sampled Or Missing Valued Time-Series Data Using LSTM Networks”, **IEEE Transactions on Neural Networks and Learning Systems**, 2020.  
(passed the first review, available on: <https://arxiv.org/abs/2005.12005>)
5. N. M. Vural, S. F. Yilmaz, **F. Ilhan** and S. S. Kozat, “RNN-Based Online Learning: An Efficient First-Order Optimization Algorithm with a Convergence Guarantee”, **IEEE Transactions on Neural Networks and Learning Systems**, 2020.  
(passed the first review, available on: <https://arxiv.org/abs/2003.03601>)
6. N. M. Vural, **F. Ilhan** and S. S. Kozat, “Stability of the Decoupled Extended Kalman Filter in LSTM-Based Online Learning”, **Digital Signal Processing**, 2020.  
(under review, available on: <https://arxiv.org/abs/1911.12258>)
7. H. Gokcesu, **F. Ilhan**, K. Gokcesu and S. S. Kozat, “Accelerating Min-Max Optimization with Application to Minimal Bounding Sphere”, **IEEE Transactions on Signal Processing**, 2020.  
(under review, draft available with permission of supervisor)
8. H. Gokcesu, **F. Ilhan**, O. Karaahmetoglu and S. S. Kozat, “Minimax Optimal Online Stochastic Learning for Sequences of Convex Functions under Sub-Gradient Observation Failures”, **IEEE Transactions on Signal Processing**, 2020.  
(under review, draft available with permission of supervisor)

1. **F. Ilhan**, O. Karaahmetoglu and A. T. Koc, “5G Channel State Estimation in MIMO Networks with Deep Learning”, to be submitted to **IEEE Transactions on Signal Processing**, 2020. (draft available with permission of supervisor)
2. **F. Ilhan** and S. S. Kozat, “Short-Term Time Series Prediction with Side Information-based Switching using RNNs”, to be submitted to **IEEE Transactions on Neural Networks and Learning Systems**, 2020. (draft available with permission of supervisor)
3. **F. Ilhan** and S. S. Kozat, “Contextually Hierarchical Online Time Series Anomaly Detection using Weakly Labeled Data”, to be submitted to **IEEE Transactions on Neural Networks and Learning Systems**, 2020. (draft available with permission of supervisor)

1. **F. Ilhan**, S. F. Tekin and B. Aksoy, “Spatio-Temporal Crime Prediction via Temporally Hierarchical Convolutional Neural Networks”, **28th IEEE Signal Processing and Communications Applications Conference**, 2020.
2. **F. Ilhan**, S. F. Yilmaz and S. S. Kozat, “A Two-Stage Multi-Class Classification Approach Based on Anomaly Detection”, **28th IEEE Signal Processing and Communications Applications Conference**, 2020.
3. **F. Ilhan**, N. M. Vural and S. S. Kozat, “LSTM-Based Online Learning with Extended Kalman Filter Based Training Algorithm”, **28th IEEE Signal Processing and Communications Applications Conference**, 2020.

4. **F. Ilhan** and E. Mumcuoglu, “Performance Analysis of Semi-Supervised Learning Methods under Different Missing Label Patterns”, **28th IEEE Signal Processing and Communications Applications Conference**, 2020.
5. N. M. Vural, B. Altas, **F. Ilhan** and S. S. Kozat, “Shortest Path Learning in Non-Stationary Environments via Online Convex Optimization”, **28th IEEE Signal Processing and Communications Applications Conference**, 2020.
6. N. M. Vural, B. Altas, **F. Ilhan** and S. S. Kozat, “Shortest Path Learning via Online Convex Optimization”, **28th IEEE Signal Processing and Communications Applications Conference**, 2020.

#### PATENTS

1. **F. Ilhan**, O. Karaahmetoglu, S. F. Tekin, I. Balaban and S. S. Kozat, “Spatio-temporal Sparse Event Prediction with Hierarchical Expert Models”, **Turkish Patent**, 2020.
2. **F. Ilhan**, O. Karaahmetoglu, S. F. Tekin, I. Balaban and S. S. Kozat, “Energy Consumption Forecasting with Time Series Clustering”, **Turkish Patent**, 2020.
3. **F. Ilhan**, O. Karaahmetoglu, S. F. Tekin, I. Balaban and S. S. Kozat, “Crime Analysis Tool for Spatio-temporal and Contextual Link Interpretability”, **Turkish Patent**, 2020.

#### PRESENTATIONS

1. “Neyman-Pearson Detection of Gauss-Markov Signals: Closed-Form Error Exponent and Properties”, Bilkent University, Ankara, 2020.
2. “On the Independence of Classifiers”, DataBoss Analytics, Ankara, 2019.
3. “The Future of Automated Driving Cars: Worldwide Availability Forecast”, Nagoya University, Nagoya, 2018.

#### ACADEMIC

##### EXPERIENCE

##### **Research Assistant**

Bilkent University, Ankara, Turkey

September 2019 – Present

- Efficient and convergent neural network learning for recurrent neural networks such as LSTMs
- Point process based spatio-temporal modeling of events with applications on spatio-temporal traffic, weather, event (crime, earthquake) forecasting
- Online switching time-series prediction algorithms for non-stationary environments with applications on finance and business

##### **Grader**

Bilkent University, Ankara, Turkey

September 2019 – Present

- EEE 585 (Statistical Learning and Data Analytics) in Spring 2020
- EEE 543 (Neural Networks) in Fall 2019

##### **Undergraduate Researcher**

Bilkent University, Ankara, Turkey

August 2018 – June 2019

- Conducted research on unsupervised video anomaly detection under the supervision of Asst. Prof. Hamdi Dibeklioglu and Prof. Dr. Suleyman Serdar Kozat.
- Developed novel statistical models to represent spatio-temporal event data.

#### INDUSTRIAL

##### EXPERIENCE

##### **Machine Learning Engineer**

DataBoss Analytics, Ankara, Turkey

June 2019 – Present

- Building end-to-end machine learning architectures for large-scale online temporal/spatio-temporal prediction and anomaly detection systems
- Developing mathematical models using advanced Python APIs.
- Developing software with the state of the art versioning and continuous integration tools.
- Working in a DevOps environment managing purpose-built, distributable and scalable services.

## Data Scientist

DataBoss Analytics, Ankara, Turkey

August 2018 – June 2019

- Analyzed complex spatio-temporal data, including traffic, crime and weather data.
- Developed statistical models to interpret spatio-temporal event data.
- Reported and presented the results to project managers, engineers and clients.

## Intern Engineer

DataBoss Analytics, Ankara, Turkey

January 2018 – March 2018

- Implemented models for face detection and panic detection in crowd scenes through reproducing academic papers.

## Intern Engineer

Roketsan, Ankara, Turkey

June 2017 – July 2017

- Wrote a Labview program that enables communication with a GPS receiver and displays/records the position, velocity, heading and time data.
- Evaluated the GPS receiver under different simulations.
- Worked on integration of GPS and INS using Extended Kalman Filter.

## PROJECTS

**Hurricane Trajectory Prediction:** Developed a deep learning architecture to predict hurricane trajectories. Introduced model is based on TrajGRU architecture and uses weather images in addition to the past trajectory data.

(Available on: <https://github.com/fatih-ilhan/hurricane-hunters>)

**Facial Attractiveness Estimation:** Implemented a CNN-based deep learning architecture to estimate attractiveness from frontal facial images. Currently working on providing more interpretability to help the users to understand which factors (pose, emotion, illumination etc.) make their photos more attractive.

(Available on: <https://github.com/fatih-ilhan/facial-attractiveness-prediction>)

**LocInCampus:** Designed and implemented a 2D outdoor localization system completely independent of GPS, for industrial design project. The system uses TDOA and CDMA techniques to perform robust and precise localization.

**Facial Emotion Recognition:** Implemented three machine learning and active appearance modeling based architectures, including CNN-based and autoencoder-based approaches, for emotion recognition from frontal face images.

**Levitating Light Bulb:** Designed an LED light bulb powered with electromagnetic induction and levitated using electromagnetic suspension. A feedback control system based on magnetic field changes performs high frequency switching to perform stabilization.

**Touchpad Controlled Audio Processing Unit:** Designed an audio processing system that consists of active filters and an amplifier controlled by a touchpad. Available features are volume control, equalizer, reverb and delay.

**Pong Game with Gesture Control:** Implemented Pong game on a 8x32 LED Matrix coded with assembly language on a 8051 micro controller. Players can control their paddles using hand gestures.

(Available on: <https://github.com/fatih-ilhan/pong>)

**Pacman Game:** Implemented a full version of the classical game Pacman, coded with VHDL.

(Available on: <https://github.com/fatih-ilhan/pacman>)

**Pixelium:** Implemented a multi-functional painting application for Android platform. In addition to standard Paint features, Pixelium provides addition features such as note taking, child lock and alarm lock with drawing puzzles.

(Available on: <https://github.com/fatih-ilhan/pixelium>)

**Ion Craft:** Designed and made an ion craft which levitates under high voltage between its poles. The designed system utilizes Biefeld-Brown effect to create ion wind.

## SKILLS

**Languages:** Turkish (Native), English (Advanced), Japanese (Lower intermediate ~N4)

**Programming:** Python, MATLAB, SQL, R, C++, Java, HTML, CSS, Assembly (8051), VHDL, GNURadio, Labview, Simulink, L<sup>A</sup>T<sub>E</sub>X

**Tools:** Deep Learning Libraries (Tensorflow, PyTorch, Keras), MLOps Tools (Kubernetes, Polyaxon, MLFlow), Development and Big Data Tools (Docker, Flask, Kafka, Spark), Agile (Gitlab, Atlassian Tools), OS (Windows, Linux), Cubase, Garageband

**Test Scores:** TOEFL iBT: 109, GRE: 149/170/3.5

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| SOCIAL     | - Bilkent University Music Club Member (2014-2017)                                       |
| ACTIVITIES | - Bass Guitarist in “Freud Goes Technical” (2014-2017)                                   |
|            | - Bilkent IEEE Student Branch Member (2014-2016)   |
|            | - Bilkent University Open Software and Internet Technologies Club Member (2014-2015)     |
|            | - Ankara Science High School Electronics Club Member (2012-2014)                         |
|            | - Ankara Science High School Physics Olympiads Team Member (2010-2012)                   |
| HOBBIES    | - Backpacking, overnight camping, being on the road, hoping to travel all over the world |
|            | - Playing bass guitar, discovering new music   |