

# Alexandra-Maria Tăuțan

 București



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## Education

### PhD Student – Automatic analysis of physiological recordings for neurological diseases

*POLITEHNICA University of Bucharest*      *Bucharest, Romania*      *October 2017 – June 2022 (Expected)*

- Algorithms for automatic detection of epileptic seizures from EEG signals – use of time and frequency domain features combined with SVM and Random Forest (RF); unsupervised feature extraction and classification
- Automatic sleep staging from polysomnographic data – in collaboration with Onera BV – see research experience description
- Detection of Parkinson's Freezing of Gait episodes from accelerometer data – deep learning classification – network adapted from AlexNet; classic features with RF; unsupervised feature extraction based on autoencoders

### Visiting PhD Student – Classification of Alzheimer's disease patients from EEG data

*Harvard Medical School*      *Boston, USA*      *March 2021 – March 2022*

- Applying classic supervised machine learning algorithms to TMS-EEG data and resting state EEG for Alzheimer's disease identification and characterization – see research experience

### Msc. Biomedical Engineering – Specialization: Biomedical Instrumentation

*Delft University of Technology*      *Delft, The Netherlands*      *September 2011 – September 2013*

- Graduation Thesis: "Evaluating Signal Quality of Dry Electrode EEG Recordings" – created a framework evaluating dry electrodes as compared to gel electrodes with common paradigm such as: resting state EEG, SSVEP, P300 speller ERPs.

### BSc. Applied Electronics

*POLITEHNICA University of Bucharest*      *Bucharest, Romania*      *October 2007 – June 2011*

- Graduation Thesis: "ECG Signal Processing" – arrhythmia detection based on wavelet decompositions

## Research Experience

### Visiting PhD Researcher

*Beth Israel Deaconess Medical Center*      *Boston, USA*      *March 2021 – March 2022*

*Massachusetts General Hospital*      *Boston, USA*      *November 2021 – March 2022*

Machine learning and signal processing applied on TMS-EEG data for classifying Alzheimer's disease patients

- Process and prepare TMS-EEG data for feature extraction.
- Features extracted in time domain: descriptive statistics, hjorth parameters, event related peak extraction, mean field potential values
- Features extracted in frequency domain based on trial z-scores – focus on delta, alpha, theta, beta and gamma bands
- Define methods for characterizing TMS-evoked EEG responses with respect to return to baseline and amplitude responses
- Apply classic machine learning models to identify Alzheimer's disease from healthy controls – Random Forest, k-Nearest Neighbors, Decision Tree.

### PhD Researcher – Automatic Sleep Staging

*Onera B.V.*      *Eindhoven, The Netherlands*      *July 2019–February 2021 (part-time)*

Development of algorithms for automatic sleep scoring using polysomnographic data (PSG);

- Extracting time (descriptive statistics, HR, HRV, RMS) and frequency features from PSG data – EEG, ECG, respiratory signals, EMG
- Creating classification based on AASM labels using supervised learning, with classic methods: Random Forest, k-Nearest Neighbours, Support Vector Machines and deep learning models: multilayer perceptron, LSTM
- Study on dimensionality reduction using Factor Analysis, Principle Component Analysis and Autoencoders

- Analysis of inter-rater reliability and impact on classification performance

## Academic Experience

### Teaching Assistant

*POLITEHNICA University of Bucharest*      *Bucharest, Romania*      *February 2018 – Present (part-time)*

- Responsible for the Biomedical Signal Processing Course from the Faculty of Medical Engineering – teaching both theoretical aspects and leading laboratory and project work using Matlab
- Responsible for the Artificial Intelligence in Biomedical System laboratory work at the ETTI, Faculty – developed teaching material using Python in Colaboratory and Github; lead laboratory and final project work.
- Guided 4 Bachelor Thesis Students and 1 Master Student in their final projects. Topics include: epileptic seizure prediction, sleep apnea detection, detection of Parkinson's disease from Gait Patterns, pneumonia detection, BCI applications etc.

## Industry Experience

### Quality & Regulatory Manager/QMS Manager

*Onera B.V.*      *Eindhoven, The Netherlands*      *January 2020–February 2021(part-time)*

- Obtained and maintained ISO13485 certificate and CE mark for first developed product; FDA submissions and registrations
- Provide guidance and participate in drafting and reviewing Clinical Evaluation Plans and Reports for polysomnography system; Lead the Post-Market surveillance process – author the PMS plan and report.
- Actively participated in the definition of processes and SOPs in compliance with FDA 21 CFR 820 and ISO13485:2016
- Providing support during design activities for ensuring compliance to general GDP and FDA regulatory requirements. Providing assistance in audits for ISO 13485:2016 certification audit

### Consultant

*Onera B.V.*      *Eindhoven, The Netherlands*      *August 2018 – January 2020 (part-time)*

- SpO2 algorithm development from PPG data
- Support for PPG signal quality improvement

### Freelance - RA&QA medical devices

*Freelance*      *Bucharest, Romania*      *December 2017 – October 2019*

- Provide support to startup clients on Quality and Regulatory for medical devices in EU e.g. registration in Italy, gap analysis of TF for MDR, writing SOPs and creating forms, updating QMS according to ISO 13485:2016; audit preparation supports
- Recruit and train a team of 3 Junior Quality Analysts; Assign tasks related to Quality; provide feedback and monitor progress

### Consultant in Regulatory and Quality Affairs for Medical Devices

*Qserve Group B.V.*      *Eindhoven, The Netherlands*      *January 2016 – September 2017*

- Junior and Medior Consultant in Regulatory and Quality Affairs for Medical Devices.
- Technical file (STED) - compiling of submission and contact with European Notified Bodies/notification of market access in NL - Class I and Class IIa software medical devices
- Compliance of medical software to IEC 62304, IEC 62366

### Biomedical Application Developer

*IMEC-NL/Holst Center (via ENTER BV)*      *Eindhoven, The Netherlands*      *November 2013 – October 2015*

Part of the R&D team working on a wearable physiological signal acquisition module from the wrist. My main responsibilities included:

- *Algorithm development - Motion Artifact Reduction* - algorithm prototyping for both PPG and ECG signals. *Stress Detection*-estimating stress through physiological signals
- *Data Collection* - defining protocols for the data collection process for approval of the IMEC internal ethics committee.
- *Prototype tests/validation and PPG sensor optimization* for obtaining reliable physiological data

### Intern – Master Thesis: Framework for evaluating EEG recordings obtained with dry electrodes

*IMEC-NL/Holst Center (via ENTER BV)*      *Eindhoven, The Netherlands*      *December 2012 – September 2013*

- Designing paradigms to obtain simultaneously recorded EEG signals while generating specific cortical responses

### Intern – Medical device development for Pulmonary Drug Delivery

*Philips Electronics Nederland BV*      *Eindhoven, The Netherlands*      *July 2012 – October 2012*

- Research work on the effects of patient usage on the performance of a nebulizer

## Personal Skills

<b>Team Player</b>	<ul style="list-style-type: none"> <li>As a Biomedical Application Developer at Holst Centre, to ensure proper data collection, I had to cooperate with colleagues from both hardware and software teams to obtain suitable data acquisition equipment.</li> </ul>
<b>Research and analysis</b>	<ul style="list-style-type: none"> <li>Gathering and assimilating information through a literature review</li> <li>Designing an experimental setup and defining protocols to test hypothesis and gather data for analysis with dedicated methods and algorithms</li> </ul>
<b>Problem Solving, Good Analytical Skills</b>	<ul style="list-style-type: none"> <li>Combine hardware and software knowledge to build experimental setups</li> <li>Providing solutions to client questions: UDI related implementations, provide labeling solutions</li> </ul>
<b>Project Management</b>	<ul style="list-style-type: none"> <li>As a consultant at Qserve, I managed several client projects (small companies and startups), making sure all deliverables are provided and the deadlines for certification and auditing are met.</li> </ul>

## Technical Skills

<b>Digital signal processing, Statistics, Classification</b>	<ul style="list-style-type: none"> <li>Experience with Fourier Transform, Wavelet Transform, digital filters (FIR, IIR), signal correlations, artifact removal techniques, ICA. PCA, descriptive statistics, linear regression, random forests, support vector machines</li> </ul>
<b>Experimental design</b>	<ul style="list-style-type: none"> <li>Designing and preparing proper experimental setups for data collection session on humans using prototype devices available at Holst Centre (both as a developer and a master student)</li> </ul>
<b>Data science, Machine Learning</b>	<ul style="list-style-type: none"> <li>Experience with descriptive statistics, machine learning algorithms such as Support Vector Machine, Random Forests, Decision Trees, Convolutional Neural Networks, Multilayer Perceptron, Autoencoders, LSTM.</li> </ul>
<b>Matlab</b>	<ul style="list-style-type: none"> <li>Used extensively during my work at Holst Centre and during my PhD work. Also used in the development of my Bachelor and Master thesis but also during my internship at Philips Electronics.</li> <li>Taught signal processing classed in Matlab</li> </ul>
<b>Python</b>	<ul style="list-style-type: none"> <li>Used during my PhD for classification tasks and data visualization. Experience with packages such as pandas, numpy, sklearn, seaborn, keras, matplotlib etc.</li> </ul>
<b>Confluence &amp; JIRA</b>	<ul style="list-style-type: none"> <li>Used as part of the development team at Holst Centre</li> <li>Used in multiple client projects while at Qserve and citoQualis;</li> <li>Used and configured as Design Change Board at Onera</li> </ul>
<b>Github, SVN</b>	<ul style="list-style-type: none"> <li>Used in industry; also in my academic experience while teaching the Artificial Intelligence in Medicine Lab</li> </ul>
<b>Latex</b>	<ul style="list-style-type: none"> <li>Used while writing the master thesis and the conference papers</li> </ul>
<b>Microsoft Office</b>	<ul style="list-style-type: none"> <li>Word, Excel, Power Point, Access</li> </ul>

## Languages

<b>Mother Tongue</b>	Romanian				
<b>Other Languages</b>		<i>Listening</i>	<i>Reading</i>	<i>Speaking</i>	<i>Writing</i>
	<i>English</i>	Advanced	Advanced	Advanced	Advanced
	<i>Spanish</i>	Intermediate	Intermediate	Intermediate	Intermediate
	<i>Dutch</i>	Intermediate	Intermediate	Intermediate	Intermediate
	<i>French</i>	Beginner	Beginner	Beginner	Beginner

## Publications

2022	A.-M. Tăuțan, E. Casula, I. Borghi, M. Maiella, S. Bonni, M. Minei, M. Assogna, S. Romanella, C. Smeralda, A. Palmisano, B. Ionescu, G. Koch, E. Santarnecchi, "TMS-EEG perturbation biomarkers for Alzheimer's Disease classification", Scientific Reports (UNDER REVIEW)
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- 2022** A.-M. Tăuțan, E. Casula, I. Borghi, M. Maiella, S. Bonni, M. Minei, M. Assogna, B. Ionescu, G. Koch, E. Santarnecchi, "Characterizing TMS-EEG perturbation indexes in Alzheimer's Disease using signal energy", 44th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 11-15 July, Glasgow, Scotland, UK, 2022
- 2022** A.-M. Tăuțan, E. Casula, I. Borghi, M. Maiella, S. Bonni, M. Minei, M. Assogna, B. Ionescu, G. Koch, E. Santarnecchi, "Preliminary study on the impact of EEG density on TMS-EEG classification in Alzheimer's disease", 44th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), 11-15 July, Glasgow, Scotland, UK, 2022
- 2022** A.-M. Tăuțan, A.C. Rossi, B. Ionescu, "Automatic sleep scoring with LSTM networks: impact of time granularity and input signals", De Gruyter Biomedical Engineering (UNDER REVIEW)
- 2021** A.-M. Tăuțan, A.C. Rossi, R. de Francisco, B. Ionescu, "Dimensionality Reduction for EEG-based Sleep Stage Detection: Comparison of Autoencoders, Principal Component Analysis and Factor Analysis", De Gruyter Biomedical Engineering, 66(2), pp. 125-136, ISSN 0013-5585, DOI: 10.1515/bmt-2020-0139, ISI Impact Factor 1.411, 2020
- 2021** A.-M. Tăuțan, B. Ionescu, E. Santarnecchi, "Artificial Intelligence in Neurodegenerative Diseases: A Review of Available Tools with a Focus on Machine Learning Techniques", Elsevier Artificial Intelligence In Medicine, 117, ISSN 0933-3657, DOI: <https://doi.org/10.1016/j.artmed.2021.102081>, ISI Impact Factor 5.326, 2021
- 2020** A. Ciurea, C.-P. Manoilă, A.-M. Tăuțan, B. Ionescu, "Low Latency Automated Epileptic Seizure Detection: Individualized vs. Global Approaches", IEEE International Conference on E-Health and Bioengineering - EHB, October 29-30, Iași, Romania, 2020
- 2020** A.-M. Tăuțan, A.-G. Andrei, B. Ionescu, "Freezing of Gait Detection for Parkinson's Disease Patients using Accelerometer data", IEEE International Conference on E-Health and Bioengineering - EHB, October 29-30, Iași, Romania, 2020
- 2020** A.-M. Tăuțan, A.C. Rossi, R. de Francisco, B. Ionescu, "Automatic Sleep Stage Detection: A Study on the Influence of Various PSG Input Signals", IEEE International Conference on Engineering in Medicine and Biology - EMBC, July 20-24, 2020, Montréal, Québec, Canada, 2020
- 2019** A.-M. Tăuțan, A.C. Rossi, R. de Francisco, B. Ionescu, "Automatic Sleep Stage Detection using a Single Channel Frontal EEG", IEEE International Conference on E-Health and Bioengineering - EHB, November 21-23, Iași, Romania, 2019
- 2019** A.-G. Andrei, A.-M. Tăuțan, B. Ionescu, "Parkinson's Disease Detection from Gait Patterns", IEEE International Conference on E-Health and Bioengineering - EHB, November 21-23, Iași, Romania, 2019
- 2019** A.-M. Tăuțan, M. Dogariu, B. Ionescu, "Detection of Epileptic Seizures using Unsupervised Learning Techniques for Feature Extraction", IEEE International Conference on Engineering in Medicine and Biology - EMBC, July 23-27, Berlin, Germany, 2019
- 2018** A.-M. Tăuțan, A.-I. Munteanu, D. Țarălungă, R. Strungaru, G. M. Neagu (Ungureanu), "Automated classification of epileptiform discharges in EEG signals using the wavelet transform", 10th International Conference and Exposition on Electrical and Power Engineering, Iasi, Romania, October 2018
- 2018** A.-M. Tăuțan, I. Mândruță, O.-A. Băjenaru, R. Strungaru, D. Țarălungă, B. Hurezeanu, G. M. Neagu (Ungureanu), "The automatic detection of epileptic seizures based on EEG signals processing: investigation of different features and classification algorithms", World Congress on Medical Physics & Biomedical Engineering, Prague, Czech Republic, June 2018
- 2015** A.-M. Tăuțan, A. Young, E. Wentink, F. Wieringa, "Characterization and Reduction of Motion Artifacts in Wrist-worn Photoplethysmographic signals", 37th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Milan, Italy, August 2015
- 2014** A.-M. Tăuțan, V. Mihajlović, Y.-H. Chen, B. Grundlehner, J. Penders, W. Serdijn, "Signal Quality in EEG Electrodes and Skin-Electrode Contact Impedance", 7th International Conference on Biomedical Electronics and Devices, March 2014, Eseo, Angers, Loire Valley, France
- 2013** A.-M. Tăuțan, V. Mihajlović, B. Grundlehner, J. Penders, W. Serdijn, "Framework for Evaluating EEG Signal Quality of Dry Electrode Recordings", IEEE Biomedical Circuits and Systems Conference, 1st Rotterdam, The Netherlands, November 2013

## Awards/Grants participation

- 2020-2021 – Romanian-US Fulbright Research Student Grant

## Courses/Summer Schools

- 2021 – Neuromatch Academy – Deep Learning
- 2018 - TENSS – Transylvanian Experimental Neuroscience Summer School

## Presentations

- 2020 - EMBC – conference presentation - Automatic Sleep Stage Detection: A Study on the Influence of Various PSG Input Signals
- 2019 - EHB – conference presentation - Automatic Sleep Stage Detection using a Single Channel Frontal EEG
- 2019 - EMBC – conference presentation- Detection of Epileptic Seizures using Unsupervised Learning Techniques for Feature Extraction
- 2014 - Biodevices – conference presentation - Signal Quality in EEG Electrodes and Skin-Electrode Contact Impedance
- 2013 - BioCAS – conference presentation - Framework for Evaluating EEG Signal Quality of Dry Electrode Recordings

## **Conference Co-Chair**

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- 2019 EMBC – “Novel Methods for the Detection and Prediction of Epileptic Seizures”

## **Journal papers reviewer**

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- Elsevier Biomedical Signal Processing and Control
- Elsevier Journal of Applied Research and Technology
- De Gruyter Biomedical Engineering/Biomedizinische Technik
- Springer Medical & Biological Engineering & Computing
- Sensors and Actuators: B. Chemical