First Year Medical Student | Neurotechnology & Biosignal Research Focus
Istanbul University - Istanbul Faculty of Medicine
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Deniz Tuncer Tepe

Research Profile

First-year medical student with a developing research focus on neuroscience, neurotechnology, and biosignal analysis. Currently building foundational experience in EEG-based signal processing, wearable sensing systems, and AI-assisted data analysis, with a strong interest in long-term academic research.

Education

Istanbul University – Faculty of Medicine (Çapa)
Doctor of Medicine (MD), Year 1
2024 – Present

Research Interests

- Non-invasive physiological signal analysis
- EEG signal processing & source localization
- Wearable health technologies
- Multimodal biosignal analysis (mechanical & physiological signals)
- Neurotechnology & biomedical AI

Research Experience

Ongoing Research – Wearable Sensing for Swallowing Analysis
Under supervision of Prof. Dr. Beren Semiz (Koç University)
2024 – Present

- Involved in an ongoing research project focused on non-invasive analysis of swallowing-related physiological and mechanical signals
- **Contributions include:**
    - Literature review on dysphagia and swallow segmentation
    - Exploration of open-access biosignal datasets
    - Conceptual discussions on signal processing and model design
    - Collaboration with engineering researchers on preliminary analytical models
- Project currently in early research phase, structured for further experimental expansion

EEG Research Exposure – Neurophysiology Laboratory
Istanbul University Faculty of Medicine, Under the supervision of Prof. Dr. Tamer Demiralp
2024 – Present

- Active involvement in EEG experiments and data acquisition sessions
- Hands-on experience with:
- EEG electrode placement and gel-based preparation
- Experimental setup and participant preparation
- Real-time troubleshooting during EEG recordings
- Currently developing foundational knowledge in:
- ERP and time–frequency analysis
- EEG preprocessing and interpretation using MATLAB

Automated 3D EEG Electrode Identification & Labeling Pipeline
Role: *Lead Developer & Researcher*
Date: *Jan 2026 – Present*

Key Contributions & Technical Stack:
- **Automated Localization:** Developed a Python-based pipeline that identifies EEG electrode positions from 3D head scans using **Gaussian Curvature** analysis for feature extraction and **DBSCAN** for spatial clustering.
- **Standardized Mapping:** Implemented a registration algorithm using **Affine Transformations** (Least Squares) to map detected coordinates onto the standard International 10-20 system.
- **Coordinate Systems:** Integrated automated alignment of 3D meshes to the **RAS (Right-Anterior-Superior)** coordinate space to ensure compatibility with neuroimaging standards (MRI/CT).
- **Efficiency:** Reduced manual electrode digitization time from approximately 20 minutes to several seconds, minimizing human error and inter-rater variability.
- **Interoperability:** Developed export modules for standard neurophysiology formats (e.g., .locs, .elp) to support integration with FieldTrip, EEGLAB, and MNE-Python.
- Code & Report: https://github.com/deniztuncert/automated-eeg-localization/tree/main

Laboratory Development Experience
3D Anatomy Laboratory – Istanbul University
Founding & Coordination Role (Setup Phase)
2024 – Present
- Actively involved in the establishment of a 3D Anatomy Laboratory within the Anatomy Department
- **Responsibilities include:**
    - Planning laboratory infrastructure and equipment usage
    - Integration of 3D scanning, modeling, and visualization tools for educational and research purposes
- Expected continued involvement in research activities following official laboratory setup

Data Analysis Experience
- Independent analysis of multivariate clinical stroke datasets using Python
- Utilized NumPy and Pandas for data cleaning, feature exploration, and statistical inspection
- Produced a documented Jupyter Notebook report linking clinical variables to neurological outcomes
- This exploratory work inspired subsequent research ideas in neurophysiology and wearable sensing
- Code & Report: github.com/deniztuncert/AI-Tip-Portfolyosu

Technical Skills
Signal Processing & Data Analysis
- EEG analysis (ERP, TFR – foundational level)
- MATLAB (signal processing, data visualization)
- Familiarity with FieldTrip concepts (learning phase)
- Jupyter Notebook-based data analysis
- 3D Geometry-based Electrode Localization
- Spatial Clustering (DBSCAN)

Programming & Tools
- MATLAB
- Python (NumPy, Pandas, Matplotlib, PyVista, Scikit-learn, SciPy)

- Experience with data-driven model prototyping (collaborative)
- Unity (C#) – interactive visualization and prototyping

3D & Visualization
- 3D scanning (structured light scanning)
- Basic 3D modeling and rendering (Blender)
- Point Cloud Processing
- Mesh Curvature Analysis
- 3D Coordinate Transformations

Laboratory & Research Skills
- EEG data acquisition and electrode placement (hands-on participation in experimental recordings)
- Signal preprocessing and analysis (MATLAB and Python)
- Basic anatomical dissection and 3D anatomical visualization (Department of Anatomy)
- Familiarity with standard laboratory instrumentation

Engineering & Project Experience
Applied Software Projects
- Developed an educational mobile application containing 30 interactive games (Bursa Park project)
- Previously delivered paid software projects for technology-oriented organizations (including Teknopark-related initiatives)

Languages
- Turkish – Native
- English – Fluent
- Japanese – Beginner (self-study; academic interest)

Additional Activities
- Classical piano – 13 years of formal training
- Classical violin (beginner, orchestral participation)
- Playing in the faculty basketball team
- Strong interest in interdisciplinary research bridging medicine, engineering, and neuroscience

References
Ayşin Kale - MD Professor of Anatomy
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