

# Graduation Design Project Recommendations by Uluğ Bayazıt

## for 2026 – 2027

**AI Agent Workflow Automation for ABET course performance assessment:** In this project, you will use an AI agent framework to automatize workflow for ABET course performance data analysis.

AI Agent frameworks are platforms, tools, or libraries designed to create autonomous agents that perceive input, process it using algorithms or LLMs, and take actions such as retrieval-augmented generation, initiating workflows, or general conversations. These frameworks streamline agentic workflows by offering pre-built modules for common functionalities, saving developers valuable time and ensuring the workflow remains transparent and robust. AI agent frameworks are tailored to different needs: some specialize in conversations, virtual assistants, or chatbots, while others focus on workflow orchestration. Their key value lies in abstracting complexity, breaking tasks into manageable steps, and ensuring scalability.

ABET (Accreditation Board for Engineering and Technology) accredits programs of higher educational academic institutions. Through the accreditation of academic programs, recognition of credentials and assessment of student learning, ABET supports excellence in higher education worldwide. Perhaps the most important feature of these accredited programs is their demonstration of continuous improvement. For continuous improvement, ABET obligates the institutions to evaluate the performance of their programs in terms of student outcomes. One of the major means of such evaluation is through course performance assessment facilitated by the mapping of course grades to these outcomes.

Based on such mapping, it is conceivable that an AI agent can carry out data analysis on the most recently obtained grades of a course and make meaningful comparisons to other courses in the program or offerings of the same course in previous terms. The agent should be able to report on such comparisons and course weaknesses and strengths on a per student outcome basis when confronted with appropriate queries. Other agents in the workflow could be deployed to e-mail, archive such reports and storing/distributing instructor opinion/action item forms.

**Efficient quantization aware training:** In this project you will use the Pytorch or Tensorflow platforms to iteratively and selectively quantize parameters of a deep neural network while the unselected weights will be frozen to save computational complexity.

Employment of quantized parameters is a viable solution for edge device applications where memory and inference computational complexity requirements are critical design considerations.

**Compression artifact removal from digital elevation/terrain maps:** Digital terrain/elevation/surface maps represent the geometrical attributes of the surface of earth. In this project, you will consider the compression of such data available from USGS Earth Explorer from different regions of the earth's surface by standards based image/video compression methods. The reconstructions output by such decoders will be improved by deep neural architectural models. Objective/subjective metrics such as PSNR, SSIM, MSSIM as well as visual assessment will be used to validate the proposed method(s).

**Compression artifact removal from 3D MRI data:** This project will further develop and add to the existent schemes for removal of artifacts introduced to the 3D MRI data when standards based image/video codecs are used to compress it. The goal is to yield a better subjective quality when reconstructions are viewed by health professionals using such data. Not only the experimental validation will be based on objective/subjective metrics but also experienced doctors and radiologists evaluate the quality improvement achieved.

This is not a new off the irons work. Existent works of some graduation design project students will be improved by incorporating and testing promising, new network models.

**Point cloud compression artifact removal:** This project aims to reduce the compression artifacts introduced to 3D and 4D point cloud data for representing static and dynamic 3D object surface geometry. The MPEG PCC/VPCC finalized in 2020 is the renowned method in this compression context and an attention based residual deep network model will be considered for removing the artifacts introduced by it.

**Predicting Outcomes in Video Games:** In this project, an attention mechanism will be used together with LSTM (Long-Short Term Memory) network to improve the pure LSTM based approach for predicting the outcome of video games (in particular two-player games).

**Cheating detection in FPS games:** In this project, you will investigate the deep learning based approaches for detecting cheating in FPS games like use of aimbots.

#### **Temporal change detection in remote sensing using deep learning:**

It is of interest to detect changes in landcover type over time in various applications related to remote sensing data. Towards this end, multiple frames captured over a certain region convey more reliable information than only two frames as in binary change detection. In this project, straightforward deep learning architectures (e.g. U-Net, Conv-LSTM) for mapping pixels to pixels will be used to determine changed regions by employing multiple temporal frames.

#### **3D Reconstruction of Faculty of Computer and Informatics Engineering Building using Drone Footage and NERFs/Gaussian Splatting3D**

A 3D geometry model of the Faculty of Computer and Informatics Engineering building and its surroundings at ITU is going to be reconstructed in this project by taking multiple aerial photos of the building using drones and applying deep learning based computer vision techniques. One might either minimize a loss function based on images by projecting the 3D model output onto several planes (Neural Radiance Fields) or start with a coarse reconstruction made by traditional methods and refining it sampling Gaussians fitted to coarse points.

### **Hallucination Detection in Counting of VLMs by Object Detection Grounding**

Can object detection be applied to improve prompts given to a VLM in counting of objects in a scene? You might want to integrate positional information yielded by YOLOV8 to enrich a prompt and see if counting accuracy improves or not? Can the VLM eventually learn to supersede the performance of YOLOV8?

### **Crowd Counting by VLMs**

Can a VLM roughly estimate the count of similar objects (like heads in a stadium) without identifying every single object? Can other deep learning based methods assist such learning?

### **VLM answering questions on depth for visually impaired**

In this project, binocular (more challenging is monocular) vision systems, object detection methods (YOLOV8) and VLMs will be used to reveal the depth information regarding a scene. Intelligent prompts will uncover spatial relations among objects (table is nearer than the person sitting on a chair, the picture on the wall is at the same depth as the vase on the table)

### **Applications of VLMs**

Projects related to navigation, driving, generative media, room design, document understanding, web navigation, interactive face expression generation.