

Project No	Lecturer	Project Title	Project Topic	Requirements	Additional Notes
1	Fatih Nar	LLM based chat-bot for the department	Large language models (LLMs) become extremely powerful and popular recently. Known examples are GPT-4, LLaMA, and Google Bard. These system will able to answer e-mails and question asked by students from a web-interface based on the given documents prepared by the department. It will also highlight the corresponding part in the document.	Python, interest in Machine Learning	Group will contain 3-4 students
2	Fatih Nar	Course Schedule Optimization	In this project you will collaborate with students from Industrial Engineering department. Together you will develop a course scheduling software which uses an existing optimization library (i.e, Gruboi: https://www.gurobi.com/).	Ready to work on optimization techniques and collaborate with student from Industrial Engineering department. Eager to learn a software library such a Gurobi. Having web development skills.	Project group will contain 2-3 students from CENG department and 2-3 students from Industrial Engineering department.
3	Abdullah Bülül	Tree Track 2	This is a follow up project from a successful one supported by Tubitak 2209-A program. We have a tablet (Redmi Pad 6GB-128GB) acquired with this project, that you can use through the year. Also, the students from the previous year can help you for the adaptation process. In this project, the basic idea is to develop a mobile application where people can easily take photos and notes for the trees, flowers, or vegetables that they grow. It helps monitoring and recording the development of trees or similar things. In the previous project, students designed the program and implemented the core functionality using React Native SDK This year our aim is to convert this application to a real usable product by implementing the missing and extra functionalities and by extensively testing it. We can also change some design decisions. At the end of the project a broader future aim is to generate a database of growing plants and use artificial intelligence for analysis over the accumulated data.	Adaptation to an existing project and improving it. Develop and test a mobile app. Improve the graphical user interface. Setup a robust database for the backend. Use GPS/map technologies.	We can discuss additional details.
4	Baha ŞEN	Stereo Matching using Multi-Resolution Images on CUDA	The stereo matching technique is used to calculate the depth of objects in an image derived from real-time scenes. Due to the high calculation cost in this method, parallel calculation techniques will be used.	C/C++, Parallel Programming	

5	Baha ŞEN	Efficient pseudo-random number generation for monte-carlo simulations using GPU	A hybrid approach based on the combination of three Tausworthe generators and one linear congruential generator for pseudo random number generation for GPU programming as suggested in NVIDIA-CUDA library has been used for MONTE-CARLO sampling. On each GPU thread, a random seed is generated on fly in a simple way using the quick and dirty algorithm where mod operation is not performed explicitly due to unsigned integer overflow. Using this hybrid generator, multivariate correlated sampling based on alias technique has been carried out using both CUDA and OpenCL languages.	C/C++, Parallel Programming	
6	Baha ŞEN	A Learning Framework for Deformable Medical Image Registration	Image registration, the process of aligning two or more images, is the core technique of many (semi-automatic) medical image analysis tasks. Recent studies have shown that deep learning methods, notably convolutional neural networks (ConvNets), can be used for image registration. Thus far training of ConvNets for registration was supervised using predefined example registrations. However, obtaining example registrations is not trivial. Deep Learning Image Registration (DLIR) framework ConvNets are trained for image registration by exploiting image similarity analogous to conventional intensity-based image registration. After a ConvNet has been trained with the DLIR framework, it can be used to register pairs of unseen images in one shot.	C/C++, Parallel Programming	
7	Yusuf Evren Aykaç	A Mobile Game Project	A hypercasual game is being developed for targeted mobile devices with a focus on user retention and monetization.	good skills in object-oriented programming, A touch of enthusiasm.	You can only create a group comprising three or four individuals. Smaller or larger group sizes may not be allowed.
8	Yusuf Evren Aykaç	A Mobile Game Project - group #2	A hypercasual game is being developed for targeted mobile devices with a focus on user retention and monetization.	Good OOP skills, a touch of enthusiasm, you should consider taking the software design patterns course if you haven't already.	You can only create a group comprising three or four individuals. Smaller or larger group sizes may not be allowed.
9	Yusuf Evren Aykaç	A Sentiment Analysis Project	Opinion mining, to be determined later with the group.	Having a broad knowledge of machine learning algorithms and the underlying mathematics is advantageous.	You can only create a group comprising three or four individuals. Smaller or larger group sizes may not be allowed.

10	Fatih Nar	Deep Learning Research Project	I will choose a research topic related to Deep Learning. Note that, you should know PyTorch, Neural Networks and have a good level of mathematics.	BA or higher from Neural Networks course	
11	Fatih Demirci	Automatic Recognition of Baby Crying Sounds	This project aims to develop a system based on deep learning techniques to analyze baby crying sounds and identify their needs. By employing speech signal processing and deep learning methods, the system will automatically understand if the baby is hungry, sleepy, experiencing colic, or has other specific needs, and provide appropriate suggestions to the parents.		
12	Fatih Demirci	Personality-Based Book Recommendation System for Children	This project aims to develop a system that analyzes the content of books and provides book recommendations suitable for the personalities and age groups of children. The system will evaluate the content and language of books to determine whether they are appropriate for specific personality traits and age groups.		Students should have required background in Deep Learning and Python Programming.
13	F. Şükrü Torun	Load balancing for heterogeneous computing platforms	In this project, a program for maintaining load balance for heterogeneous processors including different sets of CPU and GPU will be developed. The heterogeneous processors will work together in synergy and their performance will be combined to accomplish a faster running time for a specific task.	A good knowledge of parallel computing	
14	Mustafa Yeniad	Log Monitoring, Analysis and Anomaly Detection By Using Machine Learning	"Log Management and Analysis" is essential for both security and compliance and also has a crucial importance for cybersecurity. ELK Stack is a leading open-source IT log management solution for centralized logging and useful when attempting to identify problems with servers or applications, as it allows to search through all of the logs in a single place. DevOps, security professionals, system administrators, network administrators, web developers, and site reliability engineers can use them to make better data-driven decisions. Aim of this project is collecting, parsing, archiving, visualizing, and analyzing the logs produced by network services in centralized and dockerized fashion.	Machine Learning, Networking and Linux System Administration, Microservices, and ELK Stack.	
15	Fatih Vehbi Çelebi	Research about bioinformatics	I will define a research project about bioinformatics at the start of the semester: https://en.wikipedia.org/wiki/Bioinformatics		The study will be submitted in a conference or a medium blog.

16	Fatih Vehbi Çelebi	Numerical solutions techniques of partial differential equations	Some real-life problems can be modeled using partial differential equations (PDEs). Since PDEs are complex, analytical solutions rarely exist. Instead, numerical approaches are used. In this project we will work on such a numerical approach for solving PDEs.	Numerical Methods, Scientific Computing	
17	Fatih Vehbi Çelebi	ML for Medical Image Analysis	Developing Explainable Artificial Intelligence and Machine Learning Method in Medical Image Data		
18	Fatih Vehbi Çelebi	Image Segmentation	Developing Magnetic Resonance Image (MRI) Segmentation Using gray level co-occurrence matrix (GLCM) features		
19	Abdullah Bülbül	Machine Learning based Analysis of Mobile User Interfaces	I have a dataset of mobile user interfaces composed of the shared visuals (screenshots) in google playstore along with some extra information such as application ratings (between 1-5) and user comments. There are various categories of applications such as (games, puzzle games, weather etc.) and in each category there are thousands of apps. In this project, you can try to find out a correlation between user ratings, comment sentiments, and visuals. The details of the project can be further discussed.	You need to be able to work with recent deep learning libraries to extract information from screenshots. You can also utilize some language models to gather information from user comments as well.	
20	Abdullah Bülbül	Architectural Inheritance visualization based on Mobile Augmented Reality	There are many historical or architectural attraction points in Ankara. In this project, our aim is to use a mobile device to see these structures in augmented reality. When you point your device to a direction, the heritage elements on that direction will be shown on the camera screen. When you get close to one of them, more detailed information will be shown. We will further discuss the design of the application as part of the project. Note that, there is a database structure implemented by a previous M.S student including a website and user interfaces to add new buildings and their information. I would like you to use it as the base system and add augmented reality capabilities as a separate mobile application. We can ask for support from the developer.	Mobile application development, familiarity with 3D models, mobile augmented reality, use of maps on mobile applications. Database usage.	

21	Osman Serdar Gedik	SLAM Using Thermal Data	<p>Standing for Simultaneous Localization and Mapping, SLAM tries to generate a map of an unknown environment and estimate the location of the robot with respect to that map. This technology is widely used in autonomous robotic systems and mainly utilizes LIDARs or visible cameras. In this project, you will work on a novel SLAM method that will utilize thermal data. A typical example is presented in [1].</p> <p>References [1] Saputra, M. R. U., Lu, C. X., de Gusmao, P. P. B., Wang, B., Markham, A., & Trigoni, N. (2021). Graph-Based Thermal-Inertial SLAM With Probabilistic Neural Networks. IEEE Transactions on Robotics.</p>		
22	Osman Serdar Gedik	Pseudo-LIDAR for Thermal Data	<p>Due to its 3D representation capability and robustness to illumination conditions, LIDARS are widely used in autonomous applications. However, although the prices are lowering thanks to advancements in technology including solid state LIDARs, price is still the main drawback of those sensors. With this motivation, there are recent approaches that try to mimic LIDAR data using visual data [1]. In this project, students are expected to review state of the art in pseudo-LIDAR methods, understand underlying theory and collect associated datasets. The main task in this project is to apply pseudo-LIDAR methods to thermal data, compare different methods and report limitations.</p> <p>References [1] Wang, Y., Chao, W. L., Garg, D., Hariharan, B., Campbell, M., & Weinberger, K. Q. (2019). Pseudo-lidar from visual depth estimation: Bridging the gap in 3d object detection for autonomous driving. In Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (pp. 8445-8453).</p>		

23	Fadi YILMAZ	Bug Detection with Mutation-Based Fuzzer (A)	A mutation-based fuzzer takes a valid input for the target program and works by creating random mutations/changes to generate new test cases. Mutation-based fuzzers are application-independent, and so they do not have any knowledge about input format (protocol format) accepted by the target program. The fuzzer aims to detect any design flaw in the implementation of the target program by running the test cases it generates. Students are expected to build a mutation-based fuzzer that works as explained.	Basic information security knowledge and being qualified in any programming language	
24	Fadi YILMAZ	Bug Detection with Mutation-Based Fuzzer (B)	A mutation-based fuzzer takes a valid input for the target program and works by creating random mutations/changes to generate new test cases. Mutation-based fuzzers are application-independent, and so they do not have any knowledge about input format (protocol format) accepted by the target program. The fuzzer aims to detect any design flaw in the implementation of the target program by running the test cases it generates. Students are expected to build a mutation-based fuzzer that works as explained.	Basic information security knowledge and being qualified in any programming language	
25	Fadi YILMAZ	Apache Tomcat Honeypots	The project will be to construct a honeypot that emulates some basic services of the ApacheTomcat server. The honeypot will be categorized as a low interaction production honeypot. As a low interaction honeypot, it will provide only limited services for the attacker to interact with. The honeypot's interaction with the attacker will be achieved utilizing scripts that emulate interaction with the Tomcat server instead of the actual installation of Apache Tomcat. The honeypot will be able to gather information on the attacker, such as time of connection to the honeypot, IP address and port number where the attack originates from, the port number that the attacker connects to on the honeypot, and some limited functionality to allow the attacker to upload a file to the "server" that the attacker plans to use to gain control of the system. Keywords: Intrusion detection, web-server security, network security, honeypots, shell scripting	Basic web security knowledge and being qualified in any programming language	

26	Fadi YILMAZ	In-lined Reference Monitors for Virtual Reality Ecosystems	<p>The Meta (Oculus) virtual reality (VR)'s sophisticated code ecosystem, including app developers, game engine development frameworks (e.g., Unity), browsers, app stores, third-party advertising syndicates, Facebook integration, while enabling a rich user experience, can provide a breeding ground for dangerous security and privacy exploits that take advantage of the complex, cross-platform and multi-origin code convergence. Malicious actors can access a wide variety of sensitive user data such as biometrics, usage patterns and preferences, Android IDs, Facebook credentials, device IDs, etc., through programmatic channels. While currently there is some basic security and privacy vetting provided for Quest apps, such as the security vulnerability testing and the data protection assessment provided by the Oculus app store, a comprehensive vulnerability assessment, especially for attacks targeting holes in cross-platform, multi-origin, interfaced code, is yet to be established. Moreover, there is not any provable or automatic security protection for Quest apps, especially without code producer (app developer) cooperation. The broad research objectives of this proposal are to develop scientific tools and techniques, and a prototype framework, to provide automatic, provable, security for cross-platform, multi-origin Meta (Oculus) Quest apps developed using Unity, despite low expertise or little cooperation from code producers. To achieve this, we plan to refine and extend state-of-the-art language-based technologies for in-lined reference monitoring and model-checking, to provide an elegant and effective solution towards this goal.</p>	Basic web security knowledge and being qualified in any programming language	
27	Fatih Vehbi Çelebi	Artificial Intelligence Supported Wind Power Plant Site Selection: Integrated Analysis of Environmental and Economic Factors			
28	Fatih Vehbi Çelebi	A Simulation-Based Approach for Artificial Intelligence-Assisted Autonomous Drone Path Planning and Navigation			