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PROJECT 1

Company: Intel Corporation

Project title: Detection of critical nodes in the deep learning models

Supervisors: Denis Klimov, Oleg Pogorelik

Project field: Deep learning, sensitive analysis

Short description: The Deep Learning (DL) models are including relatively high number of nodes and relations. Nowadays, the application of DL models is usually running as a solid “black-box” component. Although some works have been performed in stripping rarely used nodes or nodes that are introducing insignificant errors in outputs if being removed, the detection of critical hidden nodes with high impact on the classification accuracy are not well studied yet. The goal of this project is to implement a system applying known model trimming methods (e.g., computation of the node contribution in error propagation, network pruning based node rate of use, etc.) aiming to detect the critical nodes, layers and network segments.

By the end of the project we expect to get a working system as well as a summary of the evaluated methodologies used in this work.

Value to company: Research project providing new insights on the deep learning architectures and its critical parts.

Value to student: Real experience with deep learning algorithms and frameworks.

Required course: 236501 Introduction to Artificial Intelligence

Programming language: Python; Development platforms: TensorFlow, Keras, etc

PROJECT 2

Company: IBM Research

Project title: Trusted Processing of Sensitive Data in the Cloud

Project field: Cloud security

Supervisors: Gidon Gershinsky, Oshrit Feder

Project description:
Background: Trust and privacy concerns are a significant barrier to adoption of the clouds. Commercial companies are reluctant to send their confidential information to the cloud, and non-profit organizations prefer not to use clouds to work with personal data. Information processing in cloud applications and services is done on unencrypted data, in an environment potentially shared with competitors and malicious users. The adversaries might be able to hack the system, bypass the VM / container / VPN isolation, and get access to confidential information residing in the application runtime memory. Moreover, the cloud administrator and the privileged host software (hypervisor or operating system) have a virtually unlimited access to the application data.

The project: at IBM Research, we are working on providing Trust (i.e. security and privacy) in the cloud by exploiting enclaves - hardware based secure execution environments such as Intel's Software Guard Extensions (SGX), AMD Secure Encrypted Virtualization (SEV), and software based solutions such as Homomorphic encryption (HME).

Intel SGX and AMD SEV are a novel set of hardware/software extensions to the CPU architecture that aim to provide integrity and confidentiality guarantees for sensitive computations performed in an environment where the privileged software and the system administrator are untrusted.

HME is a form of encryption that allows computations to be carried out on ciphertext directly without the need to decrypt the data before computation, thus generating a result which, when decrypted, matches the result of operations performed on the plaintext data.

Together with the Berkeley University, we investigate securing Apache Spark analytic workloads in untrusted environments, using the hardware enclaves.

In this project, you will work with SGX, SEV and HME technologies, and explore their application to cloud analytic frameworks such as Apache Spark. You will build a “big data” processing service, capable of protecting highly sensitive information in public clouds.
IBM value: information security in public clouds is a critically important subject for IBM and its clients. This project will help IBM decide on how advanced security technologies can be integrated in the overall cloud protection.

Student value: you will gain a good understanding of emerging and advanced technologies in encryption concepts and tools in the Cloud, as well as hands-on experience with Intel SGX, secure DB, Apache Spark and other technologies.

Recommended pre-requisite courses:
236350 Computer Security
234112 Introduction to Computer – C language


PROJECT 3

Company: IBM Research

Project title: Creating automatic machinery for analysis of noise in quantum computing systems

Project field: Quantum computing; Noise analysis

Supervisors: Yael Ben-Haim and Yehuda Naveh

Project description: Quantum computing is at the stage of rapidly moving from a pure theoretical concept to actual industrial realizations. As such, design methodologies and tools should be developed at meteoric pace. One of the most important challenges is verifying that the very brittle, noisy, quantum bit realizations work with sufficiently low error rates. The project will comprise of building a software package which would accept any physical noise instantiation at its input, and will automatically run the entire pipeline of noise analysis, mimicking the best available manual practices. This pipeline includes approximating the input noise by several approximation methods, comparing each of the approximations to the actual input noise by considering various metrics, running the actual and approximated noise on state
of art simulators, and producing meaningful statistics and visualizations to aid in understanding the noise processes. The project will combine concepts from optimization, simulation, statistics, probability theory, and visualization into a working software module packaged as an industrial software application. The project will be at a first-of-its-kind prototype level. While no concepts from quantum computing or noise analysis will be required up-front, the students will get acquainted with some of these concepts as part of the work, and will also have on-the-cloud access to IBM’s IBM Q computer and accompanying software tools.

**Value to the company and value to student:**

**To the company:** A first-of-its-type automated software module for the analysis of noise in quantum computers, to be used as part of the design process of physical quantum hardware. This is a crucial step in the scaling up of IBM Q from 20 to 50 qubits and beyond.

**To the students:** Participating in a cutting edge software project with immediate impact on the quantum revolution currently taking place. Building of a state-of-the-art software module with challenges in prototype design, software engineering, seamless process integration, and end-user visualization.

**Recommended background:** All ordinary-curriculum CS courses required for entering fifth semester

**Programming languages and development platforms:** Python and C++ with common (non-proprietary).

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**PROJECT 4**

**Company:** IBM Research

**Project title:** Profiling environment for Hyperledger Fabric.

**Project field:** Blockchain, distributed systems, performance

**Supervisor:** Artem Barger

**Project description:** Hyperledger Fabric is a blockchain framework implementation and one of the Hyperledger projects hosted by The Linux Foundation. Intended as a foundation for
developing applications or solutions with a modular architecture. Hyperledger Fabric is an implementation of permissioned blockchain which implies very complex set of possible configuration parameters and details. We would like to build a profiling environment for the context of the smart contracts execution to be able to measure and evaluate performance impact to spot bottlenecks. There is a need to study and analyze Fabric transaction execution model and implement several simple smart contract which will be used to benchmark the performance.

**Project goals:**

1. Learn and understand Fabric transaction execution model, identify set of potential use cases which might alleviate corner cases to spot the bottlenecks
2. Design and implement profiling test bed to be able to measure performance results of smart contracts execution, additionally being able to collect set of metrics to use for analysis later

Value for students: During the project students will be exposed to cutting edge technologies in distributed systems. Will learn and gain a lot of valuable experience in the blockchain domain with specification on permissioned networks.

Value for company: Increase adoption and expose for strategical for IBM technology and product. Building performance for smart contracts profiling will lead to impactful contribution for Hyperledger Fabric community, will also help to understand current bottlenecks and use this knowledge to provide or suggest improvements.

**Required courses:**

- 234123 Operating Systems
- 236351 Distributed Systems (optional)

**Programming languages:** golang, javascript
**Company**: Elbit Systems

**Project title**: Web based development visualization tool Elbit Software framework

**Project field**: Rich client, web application,

**Supervisor**: Dror Elul

**Project description**: Elbit System Land Division has developed an extensive Real Time software framework that allows developers to easily develop new features and to generate business data flow within the system in our various projects.

As part of this framework we want to develop a visualization tool so we can visualize and capture real time data stream and data flow. The visualization tool will be based on web application technology and will be embedded in our framework under our management interface.

This capability simplifies development and deployment of the software.

We already have a web prototype and now we are looking into getting it to the next level (improved UX, increased Data Visualization, etc.).

We will supply a Stub application and a WebServer that can run on windows and of course guidance.

**Value to the company and value to student**: this tool Improve our visibility to our framework environment this updated technology allows us in put Web Client application as part of our framework and not as a separate tools (as it is today) which will improve our deployment and ease the work.

The project will require basic web technology knowledge (Angular 5.0, JS and Type Script and NGRX), and introduce students to the newest technology web can offer. You will get better knowledge and experience on web technology which is today highly popular and well known in the industry.

**Required courses pre-requisites:**

- Data Structure (XML/JSON)
- Object Oriented Programming
- Software design
- Web Client Technologies
Programming languages and development platforms:
- Type Script
- Java Script
- Angular 5

PROJECT 6

Company: Rafael Advanced Defense Systems LTD.

Project title: Localized search engine over PDF documents

Project field: Search Engines, OCR, Data Mining

Supervisor: Oved Cohen

Project description: Rafael has been developing state of the art military systems for several decades. A great deal of the important research data was logged and archived in physical documents. This information, such as mechanical and physical models and experimental results, is still relevant to the research performed today. Important documents have been scanned into pdf documents, while more recent information is already documented in electronic documents (unstructured textual documents).

The purpose of this project is to implement a search engine over pdf documents to improve the accessibility to crucial engineering data.

Students participating in this project will gain important hands-on experience in software system development and will be guided by a senior software developer. The resulting system, shall it be successful, will be used in the heart of Israel's security and defense research centers.

System requirements:
1. The system is a standalone system, i.e it is disconnected from external networks such as the Internet. The search will be performed over a local file system containing pdf documents.
2. It should be assumed that OCR (Optical Character Recognition) should be performed on some of the documents. Students should use an existing third party solution for this implementation.
3. The most basic requirement is that the search engine will receive keywords and retrieve relevant pdf documents.
4. We encourage students to implement sophisticated search capabilities, compare several retrieval algorithms etc.
Required course pre-requisites: מת”מ

Programming languages and development platforms:
- The system should run on windows7.
- C# is advisable but not required. Students may suggest other languages or platforms that meet the system requirements.

PROJECT 7

Company: Rafael Advanced Defense Systems LTD

Project title: Human tracking by a drone (200-300 meter range to target)

Project field: Image processing, computer vision

Supervisor: Nir Zagury

Project description: Adoption of drone technology across industries became a mega trend stage fairly quickly as more and more business started to realize its potential and scope. The capability of reaching remote areas with little to no manpower needed, is one of the biggest reason why they are being adopted by different sector like: Military, Commercial and personal technology. Tracking a subject during flight is a crucial step for autonomic movement of drone. The goal of this project is to develop an image analysis algorithm to track after man target (Tracker) by using data collected by drones. During the project students will:

- Explore tracking methods which are used in different modalities
- Calibrate, improve, fuse and adjust one or more methods, to the current working point.
- Collect reasonable database which will be used for developing and testing algorithm.
  Field of view bigger than 45 degrees, and target range 200-300 meter.
- Create report and documentation

Value to the company and value to student: The ability of tracking subject during flight is innovative technology that Rafael may need in the future. The students will get opportunity to explore and develop that interesting issue in a different working point: upper perspective,
moving platform and etc. The students will promote that important issue with the help of Rafael’s engineer, who considered as pivot in that field.

**Required course pre-requisites:** 236873

**Programming languages and development platforms:** Matlab, C++

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**PROJECT 8**

**Company:** Rafael – Advanced Defense Systems

**Project title:** R-AutoML – RAFAEL AUTOMATIC MACHINE LEARNING for sensory data

**Supervisors:** Dr. Miri Rabinovitz, Ronen Kalo, Dr. Ron Zohar

**Project field:** Deep learning, sensory data; AutoML

**Project description:**

One challenge in deep learning is the difficulty in defining the features, which are hard to transfer to another problem. The difficulty lies in finding the best architecture for the deep network, especially for new problems where there is no prior experience. At Rafael, we face the challenge of finding the best architecture for identifying threats.

In the context of the solution, the students will be introduced to the following problems:

- Research in the field of AutoML and different methodologies for implementing AutoML based on deep learning.
- Performing automation for building AI (AI Author) and
- Implementing the proposed solution using similar data.
- Creating documentation.

**Value for Rafael:** Contribution to a core operational domain with applicable solutions for the domain physical problems;

**Value for the students:** Deep Experience with Deep Learning Algorithms; exposure to a core operational domain and suggesting applicable solutions for physical problems;

**Required course and pre-requisites:**

- 234247 Algorithms 1
- 236501 Introduction to Artificial Intelligence

**Programming languages and development platforms:** PYTHON;
Advantage:
- cikit-learn package
- keras package
- Tensorflow

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**PROJECT 9**

**Company:** Amdocs

**Project title:** Make quality profile (SonarQube) savable to SCM

**Project field:** Code quality tool

**Supervisor:** Assaf Katz

**Project description:**
- **Project Objective:** allow to use configuration as code for code analysis tool.
- **Short Introduction:**
  - **SonarQube** software (previously called Sonar) is an open source quality management platform, dedicated to continuously analyze and measure technical quality, from project portfolio to method.
  - The **quality profiles** service is central to SonarQube, since it is where you define your requirements by defining sets of rules (ex: Methods should not have a Cognitive Complexity greater than 15).
  - While **quality profiles** can be exported and import, they cannot be used currently by design of **configuration as code**
  - The effort contains modification all parts of this software:
    - **JAVA code**
    - **JavaScript pages**
    - **Database**

**Project scope expectations:** Supporting **quality profiles** as code SonarQube 6.3

**Expected results:** The software will allow to:
- Define quality profiles (up to limit of current export/import progress) as injected configuration
- Run the code quality check based on required profile
- Display historical quality profiles (along with existing functionality displaying of previous results)

Success criteria:
- Arbitrary file can be sent to SonarQube and used as quality profile
- All technically malformed quality profiles are rejected
- Both JAVA and JAVA script plugins of SonarQube will be able to use such quality profile
- Oracle DB and PostgreSQL as backend databases are supported
- Quality gate can be used on such profile (both success and failed)
- Support of maven, Gradle and CLI scanners

Value to the company and value to student:
- **Value to the Amdocs**: Currently this feature will enhancement the DevOps support and promote standardization and reuse, both due to better code quality and due to enhancement of FOSS.
- **Value to students**: involvement inside big free software and using a lot of various technologies - SonarQube supports 6 different runners, 4 different databases, two different UI frameworks and about 20 languages – all of them should be handled finally so the only limitation to technology to handle is the time.

Required pre-requisites (preferably):
- Good JAVA knowledge
- Basic GIT knowledge
- Theoretical understanding of code quality and configuration as code

**Programming languages and development platforms**: students can propose alternative tools and platforms.
*Limited mainly by time – see “Value to students” above

**PROJECT 10**

**Company:** Amdocs

**Project title:** Operational role based system

**Project field:** Role Based, DB, DevOps

**Supervisors:** Shaul Shnaiderman, Adi Tamir

**Project description:**

- Students will develop a web application for the operational teams that will consume data from other monitoring tools in the production environment and perform automated actions based on pre-defined set of rules, the system will analyze the monitoring text data which is pre-defined and will search for pre-defined text per every action.

- The action will need to be implemented as Unix shell scripts, those will be triggered via eyeShare system (automation platform executer with a ready-made API to invoke action).

  Reference for eyeshare: https://ayehu.com/

  **Steps:**

  - System will analyze incoming text from monitor tool in the production environment
  - The engine will perform an action according to the receiving input text and will trigger the action on other system.
  - The system will display the result of the action in a web application dashboard

**Value to the company:** help operational teams handle quickly production issues.

**Value to student:** experience working in pre-production environments working with infrastructure and development teams, get experience in web development and DevOps methodologies, building E2E system for production. Gain experience using Yii2 web platform.

**Required course pre-requisites:**
- 236703 - Object Oriented Programming – Must
- 236501 - Introduction to Artificial Intelligence - Advantage
- 234122 - Introduction to Systems Programming - Advantage

**Programming languages and development platforms:**

- Web (PHP, Html5) – Must
- Script (Bash, KSHELL) – Must
- SQL – Must
- JS, Yii2 - Advantage

**PROJECT 11**

**Company:** Amdocs

**Project title:** Automation / Orchestration platform

**Project field:** SaaS, DevOps, Operations

**Supervisor:** Adi Tamir

**Project description:** Amdocs is looking for the next generation of automation. The students will develop a web application to automate rapid tasks.

Actual development items:

1. A web application that will build and execute UNIX shell scripts and Oracle queries flows by logic that will be built by the user [please find below the examples]

2. End user should be able to perform those actions without any pre-programming knowledge.

3. User will have library of items from there he will be able to drag and drop actions and create the desired flow.

**Company value:** automate workflows to help save time on repetitive tasks and accelerate the resolution.

**Student value:** Hands on experience creating web application for automation of a real business need, Learning & understanding technologies and business for web workflow process implementation, Gain experience using Yii2 web platform
Required course pre-requisites:
- 236703 - Object Oriented Programming – Must
- 236501 - Introduction to Artificial Intelligence - Advantage
- 234122 - Introduction to Systems Programming - Advantage

Programming languages and development platforms:
- Web (PHP, Html5) – Must
- Script (Bash, KSHELL) – Must
- SQL – Must
- JS, Yii2 – Advantage

Examples:

A. User will login the system and navigate to the “Designer” tab, there he will have a set of actions he can drag and drop to build his flow:
   Scenario: user wants to check if server is up or not and act accordingly

B. configuration screen example:
PROJECT 12

Company: Medtronic

Project title: Segmentation of the Colon from capsule endoscopy images using Deep Learning

Project field: deep learning, machine learning, pattern classification, computer vision

Supervisor: Dorit Baras

Project description: PillCam Colon is a disposable capsule that uses a miniaturized camera to visualize the small bowel and the colon. The data obtained from this procedure (capsule
endoscopy) is widely used by doctors to detect and monitor abnormalities such as polyps, lesions, bleeding and ulcers.

The colon is anatomically divided to five segments: cecum, ascending, transvers, descending and rectum. The purpose of the project is to develop a deep learning system that will automatically segment the colon by detecting the inner colon transitions. The system should be composed of two parts: a score or tag in frame level, and a higher level detection of the transitions. The students should use deep learning and other supervised learning approaches to achieve this goal.

**Value to the company and value to students:** Medtronic can use this segmentation to assist physicians by narrowing down the segment/s that are inspected. It can also improve the automatically generated report by focusing only on relevant segment/s. The students will have opportunity to work on real medical image data, and experiment with deep learning which is the cutting edge technology in machine learning, widely used in both academia and industry. The outcome of this technology may improve detection of anomalies (such as lesion, bleeding, polyps) which can help save lives.

**Required course pre-requisites:** Introduction to machine learning (236756) OR computer vision (236873) OR equivalent courses (e.g., machine learning (046195))

**Programming languages and development platforms:** python, tensorflow, matlab (advantage)
Company: Medtronic

Project title: Deep learning for demosaicing and super-resolution of compressed capsule endoscopy images

Project field: image processing, deep learning, machine learning

Supervisors: Avishai Adler, Dorit Baras

Project Description: PillCam colon is a disposable capsule that uses a miniaturized camera to visualize the colon. The data obtained from this procedure (capsule endoscopy) is widely used by doctors to detect and monitor abnormalities such as polyps, lesions, bleeding and ulcers. The purpose of the project is to develop a deep learning system that will automatically perform demosaicing of the Bayer image sensor and enhance the output resolution beyond the original sensor (super-resolution). Overall performance will be evaluated with respect to known image quality measures (i.e. PSNR, SSIM).

Value to the company and value to student: Medtronic can use the enhanced image construction to provide more detailed and accurate images to the physicians, thus assisting them in detecting and classifying pathologies. The students will have opportunity to work on real medical image data, and experiment with image processing along with deep learning, which is the cutting-edge technology in machine learning, widely used in both academia and industry.

Required course: Introduction to machine learning (236756), and preferably Signal and image processing by Computer (236327) OR equivalent courses (e.g., Image processing and analysis (046200), machine learning (046195))

Programming languages and development platforms: Python, TensorFlow, Matlab
Company: Medtronic

Project title: Detecting capsule movement direction inside the small-bowel systems

Project field: Deep learning, machine learning, pattern classification, computer vision

Supervisor: Sasha Gilinsky

Project description: PillCam Crohn’s and Pillcam SB are disposable capsules that use a miniaturized camera to visualize the small bowel and the colon. The data obtained from these procedures (capsule endoscopy) is widely used by doctors to detect and monitor abnormalities such as polyps, lesions, bleeding and ulcers.

The purpose of the project is to develop a deep learning system that will automatically detect the direction of capsule movement inside the small bowel. It is used for localization of the capsule. The input to such a system will be composed of a sequence of images and the output should indicate whether there is a forward movement, a backward movement, or it is a static segment.

Value to the company and value to student: Medtronic can use capsule direction to improve localization of the capsule inside the small bowel, hence better focusing the physician on relevant small bowel parts. The outcome of this technology can help creating automatic diagnosis, which saves physician’s time and consequently, helps to save more lives.
The students will have opportunity to work on real medical image data, and experiment with deep learning, which is the cutting edge technology in machine learning, widely used in both academia and industry.

**Required course pre-requisites:** Introduction to machine learning (236756) OR computer vision (236873) OR equivalent courses (e.g., machine learning (046195))

**Programming languages and development platforms:** Python, Tensorflow, matlab (advantage)

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**PROJECT 15**

**Company:** PTC

**Project title:** Cross platform visual positioning service

**Project field:** Computer vision.

**Supervisors:** Eldad Finkelstein, Mordecai Sayag

**Project description:** Location based services provide varying ranges of accuracy and confidence level of that accuracy depending on the technology. Using integrated cameras on variety of mobile platforms we wish to create a visual localization service (Preference for omnidirectional cameras). The first part is creating the mapping capability (SLAM) by capturing the scene using a monocular camera and exporting the map to a point cloud with descriptors for each point. The student will extract real-time feature points from a video stream to reconstruct the map. The second part is using the map for localization using supported devices by matching visual references of the SLAM and current view, by extracting feature points and locating a strong reference in the feature map.

**Value to the company:** PTC is a leader in IoT and AR in manufacturing space and interested in adding location awareness capabilities to support some of the AR use-cases.

**Value to student:** The project will be based on state-of-the-art techniques in the field of SLAM and supervised by a computer vision Technion MSc student.
Required course pre-requisites: Computer Vision 236873
Programming languages and development platforms: Android, C++, OpenCV/PCL.
https://resources.samsungdevelopers.com/Gear_VR_and_Gear_360/Gear_360

PROJECT 16

Company: J.P. Morgan

Project title: Financial stock pricing for analytical research
Project field: image processing, fintech, algo trading
Supervisors: Ran Schindler, Sassi Muallem and Alec Voronov

Project description: Market data and market data analysis are important part of the bank ability to create profitable services and products to corporate clients.

Usually corporate principal investments are very large (Mil-Bil$) and can impose big risk when put on the financial markets.

With time data analytics became more and more complicated. Today we are working with advanced tools that will enable us to better express our needs.

We want to research and develop the next generation of financial market data analytical capabilities.

One of those capabilities is automatic visualize Market Data generator.

This feature should be able to scan a handmade trading pattern generated by a trader or the analytics team run graph image analysis to detect the market pricing pattern and generate the relevant pricing data that correspond to this pattern.

Today statistical and analytical calculations rely on historical market performance, so we can use only trading patterns that already happened.

Ultimately market researchers should be able to enforce any trading pattern they wish to check. Meaning, market researchers would be able to manually sketch any market pattern they want to check and the new tool will translate it to market data.

Value to the company and value to student:
Value to the company: Output of this project will feed our research and virtual trading
Value for students: Financial and market data behavior. Image processing capabilities.

Programming languages and development platforms: Linux / Windows; Python

Recommend Background: Image processing

PROJECT 17

Company: Shutterfly

Project title: Fantastic crop

Project field: Algorithms

Supervisors: Gonny Graff, Dario De Santis

Project description: Shutterfly as a business is constantly searching for ways to provide its users with the best photo-based products (e.g., Photobook, Poster, Coffee Mug, Pillow). The ultimate goal is to offer each user the right products with the right photos in the right context at the right timing. Each of the above loosely defined constraint holds endless algorithmic challenges.

The task of this project is defined as follows: Given a photo and the dimensions of the desired crop window we would like to algorithmically produce a content-aware crop. Data available for the algorithm is a list of object locations and dimensions per photo. This cropping algorithm calculates a fitness score for image to window. Project may therefore be expanded to the following selection problem: given m crop windows and n candidate images (n>m), select the best m image to window assignments, see example below.
Our “Magicshop” widget on the website offers algorithmically created product proposals using auto-cropping.

**Value to the company:** An improved auto-crop algorithm based on new data of objects.

**Value to students:** Opportunity to tackle an interesting algorithmic problem from the real world utilizing deep-learning models in close cooperation with experienced engineers.

**Pre-requisites:** None really other than coding ability. Advantage: algorithmic orientation.

**Programming languages and development platforms:** Students’ choice

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**PROJECT 18**

**Company:** Shutterfly

**Project title:** Photo classification evaluation tool

**Project field:** Machine learning evaluation

**Supervisors:** Tomer Shalev, Omer Geiger
**Project Description:** Shutterfly as a business is constantly searching for ways to provide its users with the best photo-based products (e.g., Photobook, Poster, Coffee Mug, Pillow). The ultimate goal is to offer each user the right products with the right photos in the right context at the right timing. Each of the above loosely defined constraint holds endless algorithmic challenges.

In the Haifa site we develop machine learning / deep learning algorithms addressing different tasks as steps towards this ultimate goal. A common class of problems we address is image classification. Given an image the algorithm should be able to decide to which of the predefined categories it correlates with most strongly. Here are 2 examples:

![Product worthy photo:](image1.png) ![Not so much:](image2.png)

![True face detection:](image3.png) ![False face detection:](image4.png)

In this project, the students will design and implement a GUI tool for creating, editing, importing and exporting tagged sets of photos (aka ground-truth sets) for configurable concepts (true/false faces, product-worthy/not, etc.). Tool will allow evaluation of outputs from Machine-Learning classification algorithms against the ground-truth.

**Value to the company:** a generic evaluation tool for a variety of image classification algorithms.

**Value to students:** A glimpse into the world of machine learning / deep learning: problems, algorithms, and evaluation. An opportunity to design an evaluation tool and implement as a modern web-application.

**Pre-requisites:** advantage: Web programming basics

**Programming languages and development platforms:** Python, Javascript (Vue.JS framework)
Company: Shutterfly

Project title: Photos to art

Project field: Deep models, computer vision, Image processing

Supervisor: Marc Lousky

Project Description: Shutterfly as a business is constantly searching for ways to provide its users with the best photo-based products (e.g., Photobook, Poster, Coffee Mug, Pillow). The ultimate goal is to offer each user the right products with the right photos in the right context at the right timing.

In this project, the students will explore a variety of popart libraries and tools based on image processing and deep learning (for examples see: https://www.macworld.com/article/3125615/photography/10-photo-apps-that-use-ai-to-give-your-pics-a-new-artistic-look.html#slide1 The selected libraries will be used in a proof-of-concept flow designed and implemented by the students to create fun photo manipulations for product creation.

Value to the company: will allow offering fun products to our users. Younger image.

Value to students: applying filters and deep learning models towards building a real product.

Pre-requisites: Hands-on developer.
Advantage: python, experience with web-development, using open-source projects, image-processing utilities.

Programming languages and development platforms: Web development: python

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**PROJECT 20**

**Company:** TSG IT Advanced Systems Ltd.

**Project title:** IOT gateway for smart city

**Project field:** IOT control in Smart City

**Supervisor:** Gilad Sharoni

**Project description:** We are in the development process of a C2 (command and control) System for a Smart City. Throughout the city there will be many instances of “Smart Lighting posts”, i.e. – lamppost that are installed with of various IOT components such as lighting, video cameras, distress call buttons, environmental sensors and more. Using the C2 system, the user will be able to control the IOT components – switch light on/off, light dimming, camera movement etc. The C2 system will also be able to present the status and problem of each component, schedule operation, analyze problems and produce alerts, present the data over GIS infrastructure and more.

We would like to invite students to take part in developing components of the system (some or all): dynamic grouping of posts, smart scheduler, problem detection and alerts, reports. The development will take place both on the server side (C#) and client side (Web JS Angular).

**Value to the company and value to student:**
The student will gain knowledge in: Advanced C2 systems development, working with IOT components, developing advance client-server system.
TSG will gain the development of required advance system components.

**Programming languages and development platforms:** Server side C#, client side Web JS Angular
**Company:** TSG IT Advanced Systems Ltd.

**Project title:** Data analytic over C2 systems

**Project field:** Big data Analytic

**Supervisor:** Gilad Sharoni

**Project description:** We have developed and delivered a C2 (command and control) System, that is used as a hi-level controller over complex networks. The system collects notifications and warnings from different component in the network, builds to network topology, perform fault correlation and root cause analysis, in order to efficiently and quickly identify failures and abnormalities in the net.

In this project we aim to integrate Big Data analytic tool(s) in order to:

(a) Make better usage of the current data available

(b) Expand the abilities of the system to new abnormality detections

**Value to the company and value to student:** The student will gain knowledge in: C2 systems over complex networks, data analytics over large networks, working with operational deployed systems.

TSG will gain the first step in the process of data analytics for this system.

**Required course** (Advantage):

- 236200 Statistical data processing
- 236321 Software Engineering Methods
- 236703 Object Oriented Programming

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**Company:** TSG IT Advanced Systems Ltd.

**Project title:** Mega events managements in smart city

**Project field:** Federated systems Software Architecture

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**Supervisor:** Eran Reuveny

**Project description:** The project task is to design, develop & demonstrate an ICT solution for Mega Event. The designed solution will support the following advanced new services (iServices) such as: parking occupation info, Parking reservation, Personal recommendations for arrival using all relevant transportation modes. Project team may select to realize iServices from the following list (1-2 iServices):

- **iService A:** Pre-Event Arrival Information service
  - iService feature A1: Stadium Area Transportation Map service
  - iService feature A2: Event Transportation Modes info service
  - iService feature A3: Personalized Optional Transport mode service

- **iService B:** Trip Planning iServices
  - iService feature B1: Personalized Optional Trip plans service
  - iService feature B2: Incentives info service:
  - iService feature B3: Parking allocation service
  - iService feature B4: Just before travel info service.

- **iService C:** On Trip info iServices
  - iService feature C1: On trip Realtime Traffic information service
  - iService feature C2: Traveler guidance service
  - iService feature C3: Parking Allocation & Guidance
  - iService feature C4: Emergency event info services

**Value to the company and value to student:** TSG develops solutions for smart cities. It is now essential to design the integration between TSG’s solution & the envisioned smart cities architecture.
Students will have a unique opportunity to deal with complex system architecture & learn how to implement appropriate adjusted software development methods.

**Programming languages and development platforms**: PHP, HTML5, MySQL, Open source development platform.