2018 eBusiness Technology MSIT Practicums

This document contains one-page descriptions of the 11 Practicum projects available to eBusiness MSIT students in 2018. Please read the descriptions carefully. You are asked to give your preferences for all the projects and email your choices to Sujata Telang (stelang@andrew.cmu.edu) by NOON on Saturday, June 16, 2018. If you do not send your preferences by that time, you are giving the faculty the power to assign you to any Practicum.

You should give a preference ranking for AT LEAST YOUR TOP FIVE PROJECTS. Your first choice should be indicated by a "1", your second choice "2," etc., and your fifth choice by "5." You may rank ALL of the projects if you wish. The teams will be selected by the Program Faculty and the Program Director by June 18. There will be seven teams of 7 and four teams of 6. You will be informed of the team you are on by email. We will try to give everyone their highest choice possible, but there are several factors that must be considered:

1. The most important consideration in team composition is sponsor satisfaction. The TEAM TECHNICAL grade for the Practicum is based ENTIRELY on how well you meet the sponsor's requirements, as evaluated by the faculty (not the sponsor). We therefore choose teams whose members have the background and skills necessary for each project. For example, if a Practicum requires substantial programming, we must be sure that enough skilled programmers are on the team to do the necessary coding.

2. If everyone selects the same project, then most of you will be disappointed. For maximum satisfaction, you should try to distribute yourselves evenly among the projects. It is OK to discuss your preferences with other students before making your rankings.

3. We will try to honor your preferences but we occasionally must dip below your first few choices to ensure proper team composition.

You are advised to choose projects that interest you, without regard to the size or fame of the sponsor. NO requests to change teams once assignments have been made will be considered. DO NOT request assignment to the same team or different team from any other person. Such requests are not helpful and will be ignored.

Practicums will kick off during the week of June 25, normally on Monday, June 25. As noted in its description, one of the projects will kick off on Wednesday, June 20 because of faculty scheduling. After the kickoffs, the precise scope of each project will be negotiated between the sponsors and the teams. Each team will be assigned a Consulting Faculty member and a Program Faculty member as advisors.

Grades for the practicum will be submitted to the Registrar before the Practicum Competition on Friday, August 24, 2018. There is NO CONNECTION between your grade and the results of the competition. Each team will have AT MOST 20 minutes to give a presentation and demonstration, followed by AT MOST 5 minutes of question and answer. The judges will not know the academic grades that have been given for your work. During the question and answer period, only the judges ask questions. The audience may not. A panel of independent judges will award ONE $16,000 prize to one team for the Best Practicum. The judges will also award ONE second prize of $8,000 and ONE third prize of $4000. "Best" means the team that scores the highest based on the effectiveness of your solution and the quality of your presentation. The judges will make their decision ONLY on what takes place during the presentation and question and answer period.

To participate in the Practicum, you must agree to sign a Participation Agreement, which is part of an Educational Project Agreement that exists between the University and each Practicum Sponsor. Examples of both documents, approved by the University, are included here for your reference, but please DO NOT SIGN either right now. In some cases, you may be asked by the sponsor to sign a non-disclosure agreement because the sponsor may need to reveal confidential business information to you in connection with the project.

Once you have been assigned to a Practicum project, you will be given the Educational Project Agreement for your project and a Participation Agreement specific to your project, which you should then complete, sign, and return immediately. If a non-disclosure agreement is part of the relationship between the University and the Sponsor, you will be given that form as well. You should review both agreements carefully before choosing to sign them. Please note that you do NOT have to agree to sign the Participation Agreement or any accompanying non-disclosure agreement; if you choose not to do so, you will be assigned equivalent work by the Program Director in place of one of these externally-sponsored Practicum projects.

The standard sponsor agreement grants a non-exclusive license to the sponsor for any materials produced for the sponsor during the Practicum. The University cannot grant exclusive rights to the sponsor because, under the University Intellectual Property Policy, the students retain certain rights. Some sponsors, particularly venture-financed companies however, require full rights, which they can obtain by buying the students' rights at the beginning of the Practicum. CMU is not involved in that negotiation and CMU cannot force you to sell your rights to the sponsor. If your sponsor wants to buy rights and you do not agree, you will be assigned to a different Practicum project.

Your team MUST provide a copy of its final Practicum presentation to the Program Director by August 24, 2018. If a team does not submit its final presentation, then no one on the team will be allowed to participate in the graduation ceremony on August 26.

Background: B-Three Solutions (bthreesolutions.com) is a Pittsburgh-based company that develops custom software systems. It has been developing a platform to provide first responders with critical information about buildings in which emergencies such as fires or school shootings have occurred.

Problem: It is important for the police, fire department and emergency medical services to have accurate information, including architectural drawings such as blueprints, of venues to which they must respond. However, response to an emergency requires much more data, including real-time information such as videocam feeds, images from drones and helicopters, and location data about the position of various responders. Managing a response as it is unfolding requires making this information available immediately to site commanders who are coordinating the response. For example, a mid-sized high school may have over 100 video cameras constantly monitoring various locations. These cameras need to be correlated with a map of the building so responders can follow the movements of perpetrators and locate potential hostages or victims.

Opportunity: B-Three envisions a system that will collect and transmit real-time site information, coordinate it with static data, such as building maps and information about hazardous materials, and distribute it both to responders on-site and remote commanders. It is a complication that multiple agencies must be involved, such as police, fire, EMS, ATF (Alcohol, Tobacco & Firearms), and other law enforcement and emergency organizations. Rapid, accurate and reliable digital communications are essential.

Outputs:

(1) <u>A working prototype of a module for easily deriving a digital floorplan from a set of blueprint images, offering</u>:

- Upload of blueprint image files to be used as a guide for drawing a floorplan.
- Automatic creation of digital floorplans from the uploaded blueprint images.
- NOTE: This module will integrate into an existing floorplan creation system.

(2) <u>A working prototype of a mobile app for coordinating emergency response, with these features</u>:

- Assume all necessary static information, such as building maps, are available. B-Three already has a VFM (Video Feed Manager) system that is capable of accepting real-time feeds from large numbers of cams.
- Merge building information with cam data and present it over 4G to responder subscribers.
- Merge additional real-time data, such as body cam, drone cam or helicopter cameras.
- All information should be uploaded to a central server from which it can be dispatched as needed to any authorized responder or commander.
- Facilitate communication between different agencies via text and/or voice.
- Synchronize the static data for off-line viewing in the event of an Internet outage.
- Allow for easy onboarding of temporary users that are not already registered as subscribers, during an emergency.
- All data produced during an emergency (logins, video feeds, communications, app usage logs etc.) must be preserved as evidence.

Background Information: The Bank of New York Mellon Corporation (BNYM) was formed in 2007 through the merger of the Bank of New York and Mellon Financial. It is the largest bank in the world measured by assets under custody and administration, which total over $30 trillion. It employs over 50,000 people. The firm operates in 35 countries and serves over 200,000 professional users and millions of investors.

The Problem: BNY Mellon's Alternatives Investment business supports clients that invest in infrastructure and real estate. BNY Mellon receives a large amount of data that can be used to provide clients with insight into their businesses and to identify trends. Clients use NEXEN, BNY Mellon's online portal, to receive relevant information and interact with the bank

The Opportunity:
BNY Mellon wants to apply artificial intelligence to use information in its private combined with public data sources to discover correlations and predict outcomes in the commercial real estate sector and provide it to clients and BNY Mellon Fund Managers. Alternative data sources may include publicly available sources such as BVI (Germany), ALFI Lux (Luxembourg) and NCREIF (National Council of Real Estate Investment Fiduciaries), news sources, and even social media such as Facebook and Twitter. The goal is to predict and report potential changes in real estate economic factors to improve investment strategies and advice.

Data from public sources should be usable to predict possible outcomes based on data currently held in BNY Mellon private databases. Such possible outcomes include property valuations increasing or decreasing in an area (geographical or property type, e.g., retail) and as well as fluctuations in other real estate data types over time, e.g., rental income, occupancy rates, void cost (cost of maintaining unoccupied property), etc.

It is necessary to determine a timeline of changes for each data type as not each type will move on the same timeline. For example, valuations may move in 3 months, but rental income might only move after 1 year due to existing leases. It is also useful to predict the likely demand by investors for Real Estate Funds and therefore gauge the potential increase in Real Estate Funds for BNYM to service.

BMY Mellon also wants to utilize chatbots to allow clients to request and receive information electronically via NEXEN.

Output: A working prototype of a machine learning system offering:
1. Real estate predictive data trend analysis that can be visually displayed in NEXEN.
2. Identification of the "best" data sources, that is, the ones that contribute most to the eventual prediction.
3. Chatbots to allow users to communicate to NEXEN.

This machine learning predictive forecasting can then be presented to the BNYM client base – fund managers, underlying providers of data, e.g. property managers, and also for thought leadership marketing.

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The Problem: Document Custody performs many manual tasks throughout the document lifecycle process (review a document, fetch a document, send a document to the vault, certify a document, etc.). The volume of documents that need to be processed daily can fluctuate greatly, impacting service level agreements (SLAs), which impose conditions, such as response time, on the bank's performance. Lastly, the work force itself is dynamic and may also grow or shrink daily further complicating matters.

One of the tasks, certifying a document, is a very manual process. Today, certifications are performed require an operator to pull up a scanned document (image) and compare it to a data feed to ensure that the data on the image matches the data in the feed.

The Opportunity: Machine learning will be used to automate the certification process which will in turn eliminate human error, streamline the process, and ultimately help to ensure SLAs are met. For documents that cannot be completely certified, manual intervention will be required (through a workflow step).

Outputs: A working prototype of a machine learning system that can:
1. Develop services that could integrate with the existing SmartDocs web application and services to automate the document certification process. These services would:
    a. Perform optical character recognition (OCR) on the scanned documents
    b. Learn the format / structure of the documents to identify relevant data
    c. Compare the relevant OCR text with the data feed
    d. Send any documents that don't match to a queue for manual review and remediation or certification
    e. Populate a quality control (QC) queue with a random sample (a configurable percentage) of certified documents to be manually reviewed

2. Develop and report on key performance indicators measuring the efficiency of the developed services (straight-through processing rate, reject rate), improvement over the manual process and improvement in SLA attainment.

Background: ēlizur (elizur.com) is a Pittsburgh-based company with headquarters in the North Hills. It produces sophisticated rehabilitation products that assist patients in recovering from various musculoskeletal injuries and conditions. Therapy involves a piece of physical equipment that is used by the patient for a physician's rehab protocol exercises. For example, after a shoulder injury, the patient through exercises develops an improved range of motion while being monitored telemedically with an ēlizur virtual clinical specialist. ēlizur's products are instrumented to save limited valuable physical therapy visit to be used when more functional therapy is required. Today, physical therapy visits authorized by health insurers are often used up before the desired clinical outcomes are achieved. Because of its efficiency, the ēlizur process is much more likely to lead to a successful result. ēlizur works closely with UPMC and has licensed some of its therapy technology.

Problem: Physical therapy is much more effective if it can be performed in the home by the patient himself. The reason is simple -- a patient can spend more time exercising it home that would be possible by requiring visits to a clinic. Empowering the patient allows for maximizing the use of the limited physical therapy described above. This problem is ripe for a telemedicine solution.

Opportunity: The team will have the chance to build a system that correlates data from a therapy device with a treatment plan prepared by a trained specialist to deliver customized physical therapy to a patient at home while gathering essential data to provide patient reported outcomes.

Outputs: (1) A working prototype of a mobile app to be used at home by patients, offering:

- Ability to acquire sensor data from the therapy device, display it locally and transmit it to a remote server.
- Simple user interface to provide instructions and prompts to the patient based data from the therapy device and a treatment plan available at the server.
- The Xamarin mobile app platform should be employed to assure compatibility across multiple devices.

   (2) A working prototype of mobile app to be used by a physician, therapist or other clinician directed by the referring doctor remote from the patient, offering:

- Ability to monitor patient progress in the current and previous therapy sessions.
- Ability to communicate with the patient's device, either by voice or text.
- Ability to modify the patient's treatment plan.

   NOTE: THIS PROJECT WILL KICK OFF ON WEDNESDAY, JUNE 20.

Background: Philips Respironics (http://www.respironics.com), based in Pittsburgh, is a multi-billion dollar subsidiary of Koninklijke Philips N.V., a huge multinational conglomerate. It is a leader in the sleep and respiratory markets, providing solutions for sleep management, including diagnosis and therapy, noninvasive ventilation, and respiratory drug delivery. The sleep industry is a particularly important area in which Philips has developed expertise in providing personalized guidance, solutions, and continuous engagement to consumer. Philips is known for high-quality consumer products in many areas of healthcare.

Problem: Philips has a questionnaire-based system that identifies problems with human sleep. As one example, it offers a sleep apnea quiz at https://www.consumerhealth.philips.com/LP=140. This is condition experienced by 22 million Americans. The questionnaire is dynamic and has its own logic flow. The answers to the questionnaire are run through an algorithm that identifies up to three sleep-related problems for one user. Users are then provided advice that can help resolve their issues along with links and information about Philips products that address those conditions.

Opportunity: Philips believes that engaging in conversation with consumers, rather than through passive communication methods like typing, provide a richer consumer experience. Philips is interested in converting a web-based questionnaire into a natural-language, voice-driven system. The system should ask the questions through a text-to-speech engine and accept spoken answers as well as incorporate synced activity tracker information (if available) as an additional input into the questionnaire. The system needs to be able to understand answers to questions, prompt the user if the answer is provided in a way that cannot be interpreted by the algorithm, and encourage the user to finish the questionnaire. The system should collect the answer data, convert it to the appropriate values needed by the algorithm and run it through the Philips algorithm engine. The system should provide the results as list of the sleep challenges that the user may have and speak them to the user. Then results will also include a list of sleep hygiene tips provided by the algorithm engine that should also be spoken back to the user. The system should also provide the results to the user via email.

The team will have the opportunity to build a fully two-way conversational system using the latest voice recognition and speech synthesis techniques.

Output: A working prototype of a conversational sleep advisor system, offering:
- Input/output through Google Voice or Alexa
- Connection to the Philips algorithm engine
- Ability to add support for additional languages other than English

Philips will provide its questionnaire, logic flow, tip and algorithms engine.

Background: Philips Respironics (http://www.respironics.com), based in Pittsburgh, is a multi-billion dollar subsidiary of Koninklijke Philips N.V., a huge multinational conglomerate. It is a leader in the sleep and respiratory markets, providing solutions for sleep management, including diagnosis and therapy, noninvasive ventilation, and respiratory drug delivery. The sleep industry is a particularly important area in which Philips has developed expertise in providing personalized guidance, solutions, and continuous engagement to consumer. Philips is known for high-quality consumer products in many areas of healthcare.

Problem: It is common for people to feel sleepy during the day. Surprisingly, 43% of American adults experience daytime sleepiness so frequently that it interferes with their normal activities for at least one week each month. Daytime sleepiness can be due to insufficient or fragmented sleep, breathing disorders (e.g. sleep apnea), or alertness disorders (e.g. narcolepsy). Family doctors do not systematically ask patients about daytime sleepiness and patients commonly deny having sleepiness symptoms. Assessing daytime sleepiness by frequent sampling (a few times per hour) would be ideal. However, such methods to quantify sleepiness are impractical to enable because they take too long, involve in-lab visits, or require active user involvement.

Opportunity: It is can usually possible to tell whether someone feels sleepy by observing their eyes. Semi-closed eyelids, partially occluded pupils, or dry ("gravel"-like) eyes are clues revealing sleepiness. Recent research has established significant correlations between eye region features and validated sleepiness metrics. Computer-vision based analysis of facial images can automatically segment the eye region and extract features (pupil, iris, eyelid boundary dimensions) which can in turn be converted into established sleepiness measures. Fortunately, facial images can be captured unobtrusively using the integrated camera of a modern mobile phone. It has been estimated that average mobile phone owners perform 2.7 screen touches a minute (including tapping, swiping and clicking) while heavy users perform 5.7 touches a minute. Such intense interaction offers many opportunities to capture facial images to estimate daytime sleepiness. The desired monitor is called a "daemon" because it is always on, but unobtrusive.

The team will have the opportunity to build a mobile app monitor using modern image understanding techniques.

Output: A working prototype of a mobile phone sleepiness monitor, offering:
- Capturing a picture whenever the user performs a screen touch is required
- An underlying algorithm to detect the presence of a face and identify the corresponding eye regions with sufficient quality to perform further image analysis.
- Production of a log file with timestamps and extracted features including: pupil/iris diameters, pupil-iris center distance, second degree polynomial fitting of eyelid boundaries, and texture parameters from the sclera region. A regression model (weighted average) will be provided which will produce sleepiness estimates based on these features.

Background: Purse Power (www.pursepower.com) is a U.S. nationwide organization dedicated to closing the gender gap by implementing a simple economic idea. Women make about 80% of all purchasing decisions, control more than 50% of the private wealth in the United States and make almost 70% of investment decisions, yet only 6% of CEOs are women and even they are paid 18% less than their male counterparts. If women used their economic power to buy from companies that actively create opportunities for women and pay women fairly, there would be tremendous pressure on other companies to do so too, and the gender gap could be closed much more rapidly.

Problem: Purse Power maintains a database of almost 600,000 woman-owned and women-led companies. The technological challenge is to find and add qualifying companies, keep the data current and make it as simple as possible for a customer to find the product the customer wants from a Purse power company. For example, when buying from an affiliate of Amazon.com, there is no way to tell whether the affiliate is in the Purse Power directory or to confine a search to only such companies. One in four women is a survivor of domestic violence and/or sexual assault. To combat both, Purse Power will donate 20% of its profits to battered women's shelters and domestic violence prevention programs in the communities it serves. This will be a very significant platform for the company.

Opportunity: Purse Power envisions a Purse Power web and mobile app including a recommendation engine that makes it simple, even for a technological novice, to locate women-owned and women-led companies that offer desired products. Unless this is made possible, it will be very difficult for Purse Power to harness women's purchasing power. Part of the vision is to refer the customer to a suitable business and collect a fee on any resulting sale so that proceeds can be used to fund Purse Power's objectives.

Outputs: (1) A working prototype of a secure web and mobile app for searching products of companies in the Purse Power directory, with the following features:
- Streamlined user interface employing voice and AI to simplify entering search parameters. The app should know the user's physical location, product preferences, clothing sizes, etc., so only minimal user interaction will be necessary.
- Backend search engine that produces targeted hits to direct the user to relevant products quickly.
- Capture of purchase data so that Purse power can collect a fee for referring a sale.
- Ease of integrating product data from a directory company into the backend search engine. With half a million companies, the process must be completely automated, e.g. by spidering a company's website.
- Barcode scanning component so a user can determine whether a product is manufactured by a Purse Power company
- Social media connection mechanism so a consumer who has viewed a product on another platform (i.e., Pinterest) can be notified that a Purse Power company is selling that item either in a physical store near their current geographic location or on-line

 (2) A working prototype of a browser plug-in (like JoinHoney) that notifies a customer who is not using the app if a website being viewed is of a company in the Purse Power directory.

Background

Remitly (www.remitly.com) is an international financial services company specializing in cross-border remittances, particularly for immigrants abroad who want to send funds to their families back home. Remitly's vision is to transform the lives of immigrants by providing the most trusted financial services on the planet. This is a huge and economically important business. We are happy that one of Remitly's founders is a 2010 graduate of CMU's MSIT eBusiness Technology program.

Problem

Remitly operates a customer support center to help customers send their money where they want it go, both reliably and on time. Remitly fields approximately 150,000 customer contacts per month. Every time a customer contacts Remitly via phone, email, or chat, a customer service agent selects a reason for the contact from a predefined list of 72 choices. This data is an important part of the feedback loop by which Remitly shapes its product strategy to real customer feedback.

However:
1) Human labeling can be inaccurate. This may cause Remitly to invest in inappropriate product improvements and miss relevant insights from its customers
2) In the current system, an agent can select only one of 72 labels, but a customer may have contacted Remitly for more than one reason.
3) Labeling is not dynamic, that is, the 72 labels are predefined and, should a new reason for contact emerge, manual intervention is required to recognize the need for a new label.

Responsiveness is critical to Remitly's business model. Remitly wants its product experience to be as easy, smooth and delightful as possible. Every customer contact has costs and a 1% reduction in contacts would result in over $50K of annual savings.

Opportunity

Remitly needs to automate the prediction and labelling of customer contacts based on the text of a customer interaction. This work will require text analytics, natural language processing, and one or more machine learning approaches to frame and tackle the problem (e.g., classification, recommendation, clustering etc.). The team will have access to the text of the phone contacts, emails, and chats.

Outputs:

1) A working prototype of a tool that uses the content of a customer interaction to automatically identify appropriate contact label(s) in a ranked order. For example, a contact could be rated as 80% password reset, 70% review and 60% sending limit.
2) A working prototype module that, in real-time, identifies content of the contact and can recognize when a new customer concern has emerged which isn't accounted for within the existing label set. (This is sometimes called topic detection.) It is important for the system to recognize new problems and concerns that do not fit within the established framework.

Background: Three10 Solutions (www.three10solutions.com) is a Pittsburgh-based company founded by a long-time patent lawyer and Ph.D. biochemist to apply technology to the difficult problem of patent searching. Searching is necessary to determine whether an invention is new and the cost of obtaining a patent ($10-50K or more) is justified, and when a company is sued for patent infringement, to determine whether the patent is valid, that is, whether it was new and non-obvious when patented. Patent attorneys typically ask searchers to review prior patents and technical literature to find relevant "art." The search process is human-intensive and searchers often do not fully understand the nature of the invention, leading to the identification of a large number of irrelevant art.

Problem: Patent searching is fundamentally a natural-language problem. For a typical search, a search query is formulated that attempts to capture the essence of the invention in a series of search terms. Search software identifies art containing the searched words in various databases that contain issued patents and scientific literature and retrieves thousands of potentially relevant documents. Each of the retrieved documents must be compared with a description of the invention to determine the level of relevance, a process that can take weeks to complete, costing patentees thousands of dollars in legal fees and lost inventor R&D time.

Opportunity Three10 believes that this process can ultimately be completely automated, and natural language queries will identify a limited number of extremely relevant art. Initially, Three10 intends to build a meta-search system that "federates" a query by submitting it to multiple databases, collecting the results and ranking them based on relevance to the description of the invention. Three10 is a subscriber to several online patent search services and CMU has access to online large numbers of scientific journals. Success at this project will change the patent searching industry, by limiting the time required to review search results.

Outputs: (1) A working prototype of a patent meta-search system that:
- Receives an invention description and a search query, the search query specify what the inventor believes is new about an invention.
- Chooses from among a collection of databases which ones should be queried.
- Submits the query to the chosen databases and accumulates the results.
- Evaluates the results against the invention description to rank hits based on relevance.

    (2) The nature of patent searching changes based on the technological field of the invention. For example, searching for chemical structures is very different from searching software inventions. Three10 believes that specialized systems must be developed for different types of technology, and in this project it will only be possible to focus on two areas
- Computer software; and
- Pharmaceutical products.

Background: Trazer (www.trazer.com), based in Westlake, Ohio, is dedicated to helping people recover from injuries, particularly sports-related ones. During recovery and rehabilitation, it is important to assess the patient's progress through objective, measurable data about the patient's ability to move. This is important in determining when a patient is able to return to work or resume participation in sports. For example, when a football player sustains a concussion during a game, it is essential to know when recovery has taken place. Trazer has developed a tablet device that incorporates a depth-perceiving digital camera that can be aimed at a patient. Along with a heart-rate monitor, various patient parameters can be measured, including reaction time, speed of movement and range of motion. Trazer's product is used by numerous sports teams and rehabilitation facilities and it has collected a vast array of data concerning sports injuries and recovery processes.

Problem: As the patient moves, the company's software monitors the patient's movements and display them through a screen avatar. This provides a unique way to interact with the patient, instruct the patient to perform exercises and measure the patient's performance. It is important to do this in a standardized way so that progress can be measured against benchmarks and can be compared with the performance of other people with similar injuries. An excellent way to do this is through assessment drills, in which the patient is asked to perform various, such as blocking a soccer ball from a goal. Data regarding the patient's neuro-mechanical responsiveness, balance, gait, movement capabilities, reaction time, etc., are collected. Patient and therapist need to evaluate the patient's progress nearly in real-time in comparison to other patients who have experienced similar injuries to answer such questions as how much time remains until recovery is complete.

Opportunity: Trazer need a big data analytics platform that will enable it to extract the data it generates from drills, assessments and protocols to construct automated norms and actionable data for specific populations of patients. For example, an athlete who has experienced a separated shoulder needs to know when he will be able to rejoin his team in a fully functional state. TRAZER believes this can be determined using big data techniques from its existing database. An algorithm is needed to track the progression of the patient from recovery one stage to the next based on comparison with relevant prior patients. It is critical to determine which subset of prior patients have similar conditions. The team will develop a big data analytics platform that maps each patient's activity that is performed on TRAZER against that specific patient's demographic (e.g. age and physical condition) and against prior patients exhibiting similar conditions.

Output: A working prototype of the data and analytics platform, offering:
- Dynamic graphic visualization comparing this patient's case with historical data on other relevant patients.
- A TRAZER Score Card rating the performance of the patient compared to the norms computed from the relevant population. The scorecard must be presented in layman's terms so a patient can monitor his own recovery process against those of similar patients.
- The system should present effective real-time instructions that are immediately actionable by the clinician and patient to improve the expected outcome and shorten the time needed in therapy.
- Integration with TRAZER's existing data reporting structure and SQL database.

Background: Trazer (www.trazer.com), based in Westlake, Ohio, is dedicated to helping people recover from injuries, particularly sports-related ones. During recovery and rehabilitation, it is important to assess the patient's progress through objective, measurable data about the patient's ability to move. This is important in determining when a patient is able to return to work or resume participation in sports. For example, when a football player sustains a concussion during a game, it is essential to know when recovery has taken place. Trazer has developed a tablet device that incorporates a depth-perceiving digital camera that can be aimed at a patient. Along with a heart-rate monitor, various patient parameters can be measured, including reaction time, speed of movement and range of motion. Measurement results are reproducible and provide a quantitative measure of the patient's progress. Using an Azure cloud database, performance can be evaluated against a large population. Trazer's product is used by numerous sports teams and rehabilitation facilities.

Problem: As the patient moves, the company's software monitors the patient's movements and display them through a screen avatar. This provides a unique way to interact with the patient, instruct the patient to perform exercises and measure the patient's performance. It is important to do this in a standardized way so that progress can be measured against benchmarks and can be compared with the performance of other people with similar injuries. An excellent way to do this is through assessment drills. These are game-like scenarios in which the patient is asked to perform various movements, such as blocking a soccer ball from a goal. Unlike computer games, which only involve mouse and keyboard movements, Trazer's drills require real physical motions that are tracked by the camera. Trazer has developed a series of assessment drills but these are not implemented in software. These drills develop visual and spatial awareness, balance, quickness, agility, body control, proper posture, reaction time and sport-specific stamina.

Opportunity: Implementing drills is important, but Trazer is interested in a platform that will enable it to construct physical gaming scenarios with minimal effort. Toward this goal, the team will design a game development platform that Trazer can use to produce sport-specific drill games. The team will also implement several drills, each providing different levels of difficulty.

Outputs: (1) A working prototype of drill game development platform, enabling Trazer to generate drills with minimal effort. The drill software must present effective real-time instructions, offer realistic visual feedback, capture and store the patient's movements and track the patient's progress. Trazer employs the Unity game engine and the Electron web development framework.

        (2) A working prototypes of a set of four interactive patient drills, implemented using the platform in (1), such as:
- Trap attack: A red disk appears randomly on a floor of grid squares. The player must move to the disk's spot to cause it to disappear.
- Jump Explosion: A moving belt appears above the player with balls that spill over the belt. The player can intercept them on the way down or jump up to get them before they fall.
- Physical Breakout: Similar to the computer game of Breakout, but the player must physically move a ping pong paddle to strike at a virtual ball
- Goalie Wars: The player must deceive a virtual soccer goalie by drawing him to one side with a fake and then throw a virtual ball at the goal by a rapid forward motion

Company name ("**Course Sponsor**"):

Course title, campus location, semester & year ("**Course**"): 08-716, eBusiness Summer Practicum, Pittsburgh Campus, Summer 2017

Professor(s) teaching the Course ("**Professor(s)**"): Michael Shamos

Effective date ("**Effective Date**"):   June 25, 2018

End date of Agreement ("**End Date**"): August 31, 2018

Brief description of Course project idea (includes any materials to be supplied by and/or planned involvement of Course Sponsor) ("**Course Project**"): The Students will work on a project in the area of _____.

Financial contribution (if applicable) toward Course Project costs ("**Contribution**"):

* *

1. *Parties to this Agreement.* The Parties to this Agreement are:
    Students in the Course who elect to participate in the Course Project by signing the attached form of "Participation Agreement" (collectively, the "**Students**");

    Carnegie Mellon; and

    Course Sponsor.

    In this Agreement each may be called a "**Party**" and together they may be called "**Parties**."

2. *Purpose.* Carnegie Mellon appreciates the Course Sponsor's willingness to suggest project ideas for Carnegie Mellon's students and is excited to offer the ability for its students to participate in the Course Project described above. This Agreement documents the terms under which the Course Project will be conducted, including the rights and responsibilities of the various Parties.

3. *Ownership.* Students will retain ownership of the coursework they prepare and submit to the Professor(s) as part of the Course (the "**Student Work Product**"). Any materials provided by Course Sponsor for the Course Project will remain owned by Course Sponsor and may only be used by the Students and Carnegie Mellon for the Course Project unless otherwise permitted by Course Sponsor.

4. *Obligations of Carnegie Mellon.* Carnegie Mellon will provide to Course Sponsor copies of any and all Participation Agreements that have been signed by Students so that Course Sponsor is aware of all Parties to this Agreement. Carnegie Mellon will also provide (or cause the Students to provide) the Course Sponsor with copies of any and all Student Work Product within 60 days after the Course ends.

5. *Obligations of Students.* Each Student hereby grants to Course Sponsor a perpetual, non-exclusive, worldwide, royalty-free license to copy, modify, use, translate, publish and distribute his/her Student Work Product. Each Student also grants to Carnegie Mellon a perpetual, non-exclusive, worldwide, royalty-free license to publicly perform, publicly display, modify, create derivatives of and otherwise use for academic, educational,

administrative or research purposes (a) any and all Student Work Product, and (b) any and all Recordings (as defined below).

6. *Obligations of Course Sponsor.* Course Sponsor will pay any Contribution specified above in full in U.S. Dollars within thirty (30) days after the Effective Date and will also provide any and all materials and/or support for the Course Project specified in the description of the Course Project above.

   In addition, Course Sponsor understands and agrees that it will be given access to materials prepared as part of an educational course. If Course Sponsor elects to make use of any such materials, Course Sponsor understands that it is at Course Sponsor's sole risk and that neither the Students nor Carnegie Mellon can be responsible for the consequences of such use. As a result, Course Sponsor agrees to defend, indemnify and hold harmless Carnegie Mellon, its trustees, officers, employees, Students, attorneys and agents ("**Carnegie Mellon Parties**") from and against any and all liability, damage, loss or expense (including reasonable attorneys fees and expenses) incurred by or imposed upon any or all Carnegie Mellon Parties in connection with any claim, suit action or demand arising out of or related to any exercise of the rights and licenses granted or provided to Course Sponsor under this Agreement (including the license to the Student Work Product). This indemnity will apply to claims under any theory of liability (including but not limited to actions in the form of tort, warranty, or strict liability, or violation of any law) and regardless of whether such action has any factual basis.

7. *Disclaimers.* ANY AND ALL INFORMATION, MATERIALS, SERVICES, INTELLECTUAL PROPERTY AND OTHER PROPERTY AND RIGHTS GRANTED AND/OR PROVIDED PURSUANT TO THIS AGREEMENT (INCLUDING ANY STUDENT WORK PRODUCT), ARE GRANTED AND/OR PROVIDED ON AN "AS IS" BASIS. NO PARTY MAKES ANY WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, REGARDING ANY MATERIALS PROVIDED BY IT, AND ALL SUCH WARRANTIES, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE EXPRESSLY DISCLAIMED. WITHOUT LIMITING THE GENERAL NATURE OF THE PRIOR SENTENCE, NEITHER CARNEGIE MELLON NOR ANY STUDENT MAKE ANY WARRANTY OF ANY KIND RELATING TO EXCLUSIVITY, INFORMATIONAL CONTENT, ERROR-FREE OPERATION, RESULTS TO BE OBTAINED FROM USE, FREEDOM FROM PATENT, TRADEMARK AND COPYRIGHT INFRINGEMENT AND/OR FREEDOM FROM THEFT OF TRADE SECRETS WITH RESPECT TO THE STUDENT WORK PRODUCT. COURSE SPONSOR IS PROHIBITED FROM MAKING ANY EXPRESS OR IMPLIED WARRANTY TO ANY THIRD PARTY ON BEHALF OF CARNEGIE MELLON OR ANY STUDENT RELATING TO ANY MATTER, INCLUDING THE APPLICATION OF OR THE RESULTS TO BE OBTAINED FROM THE INFORMATION, MATERIALS, SERVICES, INTELLECTUAL PROPERTY OR OTHER PROPERTY OR RIGHTS GRANTED AND/OR PROVIDED TO IT PURSUANT TO THIS AGREEMENT. NEITHER CARNEGIE MELLON NOR ANY STUDENT SHALL BE LIABLE TO EDUCATIONAL PROJECT SPONSOR OR ANY THIRD PARTY FOR LOSS OF PROFITS OR FOR INCIDENTAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES FOR ANY REASON WHATSOVER ARISING OUT OF OR RELATING TO THIS AGREEMENT (INCLUDING ANY BREACH OF THIS AGREEMENT), EVEN IF CARNEGIE MELLON OR THE STUDENT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES OR HAS OR GAINS KNOWLEDGE OF THE EXISTENCE OF SUCH DAMAGES. COURSE SPONSOR AGREES THAT IT WILL NOT MAKE ANY WARRANTY ON BEHALF OF CARNEGIE MELLON OR ANY STUDENT, EXPRESS OR IMPLIED, TO ANY PERSON CONCERNING THE APPLICATION OF OR THE RESULTS TO BE OBTAINED WITH ANY MATERIALS, SERVICES, INTELLECTUAL PROPERTY AND OTHER PROPERTY AND RIGHTS GRANTED AND/OR PROVIDED PURSUANT TO THIS AGREEMENT (INCLUDING ANY STUDENT WORK PRODUCT).

8. *Miscellaneous.*

   8.1. The term of this Agreement will begin as of the Effective Date and end on the End Date unless sooner terminated as permitted under this Agreement. The actual Course Project will be conducted during the scheduled Course dates and times, which may be different than the Effective Date and/or End Date of this Agreement.

8.2.   Each Party agrees that it will not use the name, trademark, or other identifier of any other Party for any advertising, promotion, or other commercially related purpose in connection with this Agreement except with the prior written approval of the relevant Party.

8.3.   Students (and Course Sponsor, to the extent it is present in the classroom when recordings are being made) hereby grant Carnegie Mellon permission to make audio and/or video recordings of the work performed by them and/or their participation during the Course (the "**Recordings**") and agree that Carnegie Mellon shall have the perpetual, irrevocable, worldwide right and license to publish, reproduce, exhibit, distribute, broadcast, edit and/or digitize the Recordings in whatever form for Carnegie Mellon's internal, academic or research purposes relating to the Course and/or similar educational projects.

8.4.   Unless otherwise indicated elsewhere in this Agreement, no Party to this Agreement may assign or transfer any rights or obligations from this Agreement without the prior written consent of the other Parties. Any attempted assignment in violation of this Section will be null and void.

8.5.   Unless otherwise indicated elsewhere in this Agreement, all notices and communications in connection with this Agreement will be addressed to the Carnegie Mellon and Course Sponsor officials who sign this Agreement at the addresses noted below the signature lines, and to the Students at the addresses they list on their respective Participation Agreements.

8.6.   Either Carnegie Mellon or Course Sponsor may terminate this Agreement by giving at least thirty (30) days prior written notice to the other. In addition, Carnegie Mellon may terminate this Agreement by giving written notice to Course Sponsor in the event Course Sponsor fails to pay the Contribution by the timeframe required. In the event that Carnegie Mellon elects to terminate this Agreement due to Course Sponsor's nonpayment or breach of this Agreement, Course Sponsor forfeits the license rights otherwise granted to it under Section 5 above. Any Students may withdraw from and/or drop the Course as permitted by Carnegie Mellon practices and policies, provided that any and all Student Work Product provided to Carnegie Mellon by such Student prior to withdrawal may be used by Carnegie Mellon and Course Sponsor consistent with the terms of this Agreement. Any provision which by its nature would naturally survive the expiration or termination of this Agreement will do so (including but not limited to indemnification obligations).

8.7.   Any amendments to this Agreement must be in writing and signed by authorized representatives of Carnegie Mellon and Course Sponsor (and, to the extent such amendments affect the rights or obligations of any Students, also by such Students).

8.8.   Nothing contained in this Agreement shall prevent either Course Sponsor, Carnegie Mellon or any Student from entering into projects with third parties which are similar to the Course Project, or from independently developing (either through third parties or through the use of its own personnel), or from acquiring from third parties, technologies or products which are similar to and competitive with intellectual property resulting from the Course Project.

8.9.   If any portion of this Agreement is determined by any court or governmental agency of competent jurisdiction to violate applicable law or otherwise not to conform to requirements of law, then the rest of the Agreement will remain in effect and the parties will substitute a suitable and equitable provision for the invalid/unenforceable provision in order to carry out the original intent and purpose of the original Agreement.

8.10. In all matters relating to this Agreement, the Parties are acting as independent contractors and no Party will represent that it has any authority to assume or create any obligation or warranty on behalf of the other Parties and/or to represent the other Parties as agent, employee or in any other capacity.

8.11. The section headings herein are inserted for convenience only and shall not be construed to limit or modify the scope of any provision of this Agreement. Nothing in this Agreement, express or implied, is intended to or shall confer upon any person or entity other than the Parties any right, benefit or remedy of any nature whatsoever under or by reason of this Agreement.

8.12. This Agreement shall be governed by the laws of the Commonwealth of Pennsylvania without regard to the conflict of laws provisions. All claims and/or controversies of every kind and nature arising out of or relating to this Agreement, including any questions concerning its existence, negotiation, validity, meaning, performance, non-performance, breach, continuance or termination shall be settled exclusively in the United States District Court for the Western District of Pennsylvania or, if such Court does not have jurisdiction, in any court of general jurisdiction in Allegheny County, Pennsylvania and each party consents to the exclusive jurisdiction of any such courts and waives any objection which such party may have to the laying of venue in any such courts.

8.13. This Agreement and the executed Participation Agreements constitute the entire agreement among the Parties and supersede all previous agreements and understandings relating to the subject matter of this Agreement.

Intending to be legally bound, the Students, Course Sponsor and Carnegie Mellon agree to the terms and conditions of this Agreement as of the Effective Date.

COURSE SPONSOR: CARNEGIE MELLON UNIVERSITY:

By: _____   By: _____

Name: _____   Name: _____

Title: _____   Title: _____

Address for notices: Address for notices:
                                                  Office of Sponsored Programs
                                                  Carnegie Mellon University
                                                  5000 Forbes Avenue
                                                  Pittsburgh, PA 15213

Address for invoices:

Attachment - Form of Participation Agreement

PARTICIPATION AGREEMENT

Course title, campus location, semester & year ("**Course**"): 08-716 eBusiness Summer Practicum (Summer 2018, Pittsburgh Campus)

Professor(s) teaching the Course ("**Professor(s)**"): Michael Shamos

Company name ("**Course Sponsor**"): Design Center Pittsburgh

* *

As a part of the Course, you have the opportunity to participate in an educational project suggested by the Course Sponsor listed above.

BY SIGNING THIS FORM, YOU HEREBY AGREE TO BE LEGALLY BOUND AS A "STUDENT" TO THE TERMS AND CONDITIONS OF THE EDUCATIONAL PROJECT AGREEMENT ATTACHED TO AND INCORPORATED INTO THIS PARTICIPATION AGREEMENT. *PLEASE READ THE EDUCATIONAL PROJECT AGREEMENT CAREFULLY BEFORE YOU DECIDE WHETHER TO SIGN THIS PARTICIPATION AGREEMENT. THIS IS A LEGALLY-BINDING AGREEMENT AND INCLUDES OBLIGATIONS YOU MUST FULFILL (INCLUDING THOSE IN THE ATTACHED EDUCATIONAL PROJECT AGREEMENT). IF YOU SIGN THIS AGREEMENT AND THEN DO NOT ABIDE BY YOUR OBLIGATIONS, YOU COULD FACE LEGAL ACTION.*

STUDENTS TRADITIONALLY RETAIN COMPLETE OWNERSHIP AND CONTROL OF THE WORK THEY CREATE IN THE CLASSROOM—HOWEVER, IF YOU SIGN THIS FORM AND CHOOSE TO PARTICIPATE IN THE COURSE PROJECT, YOU WILL BE GRANTING CERTAIN RIGHTS AND LICENSES TO YOUR COURSEWORK (AS MORE FULLY DESCRIBED IN THE ATTACHED EDUCATIONAL PROJECT AGREEMENT).

IF YOU DO NOT WISH TO PARTICIPATE IN THE COURSE PROJECT AND/OR DO NOT AGREE WITH THE TERMS CONTAINED IN THIS DOCUMENT AND THE ATTACHED EDUCATIONAL PROJECT AGREEMENT, <u>YOU DO NOT HAVE TO SIGN THIS DOCUMENT</u>. YOU MAY PERFORM AN ALTERNATIVE PROJECT AS DIRECTED BY THE PROFESSORS IN ORDER FOR YOU TO FULFILL YOUR COURSE REQUIREMENTS.

By signing below, you represent and warrant that you are at least 18 years old.

STUDENT

By: _____

Printed Name:

Pittsburgh (Local) Address:
(do not list your campus office or building)

Permanent (Home) Address: