Artificial Intelligence for Occupational Safety and Health Experts
Course Project Specifications

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Project Description

Students will need to think about an Occupational Safety and Health (OSH) problem in their workplace in which Artificial Intelligence (AI) can be implemented to improve or create a solution to the problem. Any selected problem within the student's workplace is expected to have some supporting data that can be used in developing the AI solution. Students will work in teams alongside AI experts (Industrial Engineering and Computer Science students) to design the AI-OSH application. The software used in the projects is Python which is a free coding software. However, the students do not need to learn any coding with this software. AI experts are familiar with the software and all software related tasks are done by the AI experts.

High-Level Project Steps

1. Problem Definition
2. Data Exploration and Selection
3. Defining the Machine Learning Task
4. Developing the Machine Learning Model
5. Workplace Testing
6. Workplace Implementation

Low-Level Project Steps

1. **Problem Definition (completed in Week 1)**
    a. Description: An AI-OSH problem is any workplace OSH project that has the potential to benefit from the use of AI. If your problem does not have any supporting data or your problem is so trivial that can be solved by an already known formula, then that is NOT an appropriate problem for an AI solution. In a typical AI-eligible problem, there must be at least one output variable that we are interested in estimating (or predicting) its value based on a set of inputs. In addition, we must have access to a set of input instances and the corresponding output value for each instance. This set is called our data set. The appropriate size of a data set depends on the problem in hand. In some cases, even 100 instances of inputs/outputs are enough to develop a good AI model. In other cases, even 100,000 instances might not be able to help in constructing a good AI model. There are ways that we can test whether our data set has enough instances.
    b. Student Expectations: Select an OSH problem at your workplace that has the potential to benefit from AI. This step is done under the supervision of the instructor.
    c. Questions are Need to be Answered:
        i. What is the OSH problem that AI will be helping to solve?
        ii. What system metrics (i.e. hazard risk) will be improved if we can solve this problem?
        iii. Why is AI necessary?

2. **Data Exploration and Selection (completed in Week 2)**
    a. Description: In the data availability phase, all useful sources of information in a workplace for the selected AI-OSH problem are identified. Such sources should be able to provide you with the instances of inputs/outputs. Data comes in many formats such as system reports, video capturing, employee documentation, etc.
    b. Student Expectations: Identify any useful sources of information at your workplace that you can get access to within the timeframe of the project.
    c. Questions are Need to be Answered:
        i. What data sources are available that are appropriate for your project?
        ii. How do you get access to the data?
        iii. Are you allowed to share data with the AI experts in the project?
    d. NOTE: It is preferred that each student uses a data set from their workplace. However, if you have no access to data from your workplace, data will be provided for you to work on a project.
3. **Defining the Machine Learning Task (completed in Week 2)**
    a. Description: In the machine learning task phase, the problem of interest and data are considered to define feasible models that can be generated. In this step, the inputs and outputs, and their values are finalized.
    b. Student Expectations: Work with the assigned team to understand what can be done with the gathered data.
    c. Questions are Need to be Answered:
        i. Do you have enough data to build the AI algorithms? Do you have the right type of data?
4. **Developing the Machine Learning Model (Completed in Weeks 3 to 4)**
    a. Description: In the machine learning development phase, data is explored to reach the objective of the ML task.
    b. Student Expectations: Assist the machine learning team members with anything they might need during the model development process. This stage is primarily done by the AI experts members of the team but the model details are shared and discussed with the students for their feedback and potential model improvements.
    c. Questions are Need to be Answered:
        i. Does the model provide a useful prediction?
        ii. How will the model be tested and evaluated?
5. **Workplace Testing (Completed in Week 4)**
    a. Description: In the workplace testing phase, company personnel (students) utilize the developed AI-OSH system/models to explore barriers to implementation.
    b. Student Expectations: Workplace testing is done from a hypothetical standpoint. Ideally the student would consult with the workers in their workplace and report what they believe are potential barriers for workplace testing of the AI solution.
    c. Questions are Need to be Answered:
        i. What are the current problems with the AI solution that would make a worker not use the system?

6. **Workplace Implementation (actual implementation might be done after the course is finished)**
    a. Description: In the workplace installation phase, any hardware or sensing equipment is installed for workplace use.
    b. Student Expectations: Workplace implementation is done from a hypothetical standpoint. Ideally the student would involve workplace users and management to discuss barriers to implementation. From this project the student should consider barriers to implementation in their workplace.
    c. Questions are Need to be Answered:
        i. What system metrics (i.e. hazard risk) will be improved?
        ii. How do you plan to implement this new system?
        iii. What type of labor is needed to build and use this AI system?
        iv. Will you need to train individuals to use the system?
        v. What is the calculated hours of labor and cost it will take to develop and implement the AI application?
        vi. What would be the cost of maintaining this system?
        vii. What are the ethical consequences of the new system?

Project Deliverables

1. Project Proposal Presentation
    a. Students will present their initial project ideas and the data to support their project idea via a PowerPoint presentation by the end of **Week One** and receive instructor feedback. Templates will be provided via blackboard for students.
2. Project Progress Presentation
    a. Students will present a project update of their half design of the AI-OSH system in the beginning of **Week Three** and receive instructor feedback. Templates will be provided via blackboard for students.
3. Final Design Presentation
    a. Students will present their final design and finding of their AI-OSH project and receive instructor feedback on the **last day of instruction**. Templates will be provided via blackboard for students.

Please note: Actual implementation of AI solutions cannot be done during this course. Participants should not expect to reach and implement a complete AI solution in the weeks of this course. Participants get to design solutions, but the implementation is a separate task that needs more time and resources. Additionally, not every data set that a participant brings might be eligible for the type of project that we do in this course. Final approval of projects will be done by the instructor after discussing with participants. Finally, whatever data/methods participants bring, or develop during the course, belongs to them (IP rights), UIC will not claim any ownership of that.