# COMP 6721 Applied Artificial Intelligence (Fall 2020)

## Project Assignment Part I

**Due date (Moodle Submission): Friday, November 20th**
**Counts for 50% the course project**

**AI Face Mask Detector.** You have to develop an AI that can analyze face images and detect whether a person is wearing a face mask or not:

| | | |
|---|---|---|
|  |  |  |
| **Person with Face Mask**[1] | **Person without Face Mask**[2] | **Not a Person**[3] |

Towards this end, you have to develop a Deep Learning *Convolutional Neural Network* (CNN) using *PyTorch* and train it to recognize three different classes: (1) Person without a face mask, (2) Person with a face mask, and (3) Not a person (i.e., any other image). You will have to collect suitable training data and evaluate the performance of your system:

**Training Data.** Create datasets for training and testing your AI. You have to provide provenance information, i.e., where you obtained each image in your dataset. You can re-use existing datasets, but again please make sure you properly reference the source of the images (name, author, source, license of the dataset). Also, note the additional evaluation task that will follow in Part II of the project mentioned below when setting up your dataset.

**Deep Learning.** Create a suitable Convolutional Neural Network (CNN) architecture, implement it in PyTorch, and train it using your dataset.

**Evaluation.** Evaluate your model, creating a table of results showing the *accuracy, precision, recall* and $F_1$*-measure*, as well as a *confusion matrix*.

**Team Specialization.** While all team members have to contribute equally to the project, you should designate one person who is mainly responsible for each of the following three tasks in the project: A *(I) Data Specialist*, responsible for creating, pre-processing, loading & analyzing the datasets; a *(II) Training Specialist*, responsible for setting up and training the CNN; and a *(III) Evaluation Specialist*, responsible for analyzing, evaluating, and applying the generated model. Each specialist has to write the corresponding part in the project report, detailed below. Note: this does not mean the designated person has to do all the work for the tasks, but rather is mainly responsible and can define and distribute sub-tasks to the other team members.

**Report.** You have to write a report on your work with the following information:

**Title page:** showing your group information (team name, team members, ID numbers).
*Length:* 1 page

**Dataset:** Describe how you built your dataset and where you collected images (provide details on each image's source in a file). Provide statistics on the size and structure of your dataset, i.e., how many images you have in each class.
*Length:* ca. 1 page

**CNN Architecture:** Describe the architecture of your CNN and provide details on the training (how many epochs you trained, etc.).
*Length:* ca. 1 page (excluding images/diagrams)

**Evaluation:** Evaluate your model and provide the tables mentioned above. Discuss the results and explain how and where you want improve during the second phase of the project (also see Phase II details below).
*Length:* ca. 1 page

**Reference Section:** containing citations to all relevant resources that you have consulted (books, Web sites, . . . ), even if it was just to inspire you. Failure to properly cite your references constitutes plagiarism and will be reported.

**Project Phases I and II.** The goal of this first phase of the project is to set up the complete AI learning & evaluation process and gather first results. You can improve the design and collect further training data for the final submission. In other words, do not overly worry about the performance at this step, rather focus on a proper design of your datasets and evaluation process, so that you can further improve it in the second phase of the project.

***Phase II Preview:*** In Part II of the project, the only new task will be an extended evaluation of your AI, where you have to determine if your model exhibits any kind of *bias*, i.e., whether it performs differently for faces depending on age, gender, or race.

***Deliverables.*** Your submission must include the following deliverables within a single `.zip` or `.tgz` archive:

**Python code:** All the Python code that you developed for this project.

**Dataset:** The dataset you collected, as well as a file detailing the source of each image.

**README:** A `readme.txt` (or `readme.md`) file that lists all submitted files with an explanation of their content. It also must describe how to run your code for (a) training and (b) testing (including generating the evaluation results provided in the report). If your instructions are incomplete and your code cannot be run you might not receive any marks for your work.

**Report:** The project report, as detailed above, in PDF format.

***Submission.*** You must submit your code electronically on Moodle by the due date (late submission will incur a penalty, see Moodle for details). Include an *Expectation of originality* form (see https://www.concordia.ca/encs/students/sas/expectation-originality.html), (electronically) signed by all team members.

***Demo.*** We will schedule online demos sessions for your project using Zoom.

*Photo credits:* [1]Agência Brasília from Brasília, Brasil (https://commons.wikimedia.org/wiki/File:Campanha_da_Secretaria_de_Justiça_ensina_a_produzir_máscaras_caseira_(49749797561).jpg), "Campanha da Secretaria de Justiça ensina a produzir máscaras caseira (49749797561)", Cropped, https://creativecommons.org/licenses/by/2.0/legalcode;
[2]Airplaneman (https://commons.wikimedia.org/wiki/File:Lightning_presentation_Wikipedia_Day_Chicago_4.jpg), Cropped, https://creativecommons.org/licenses/by-sa/4.0/legalcode
[3]Rbreidbrown (https://commons.wikimedia.org/wiki/File:Domestic_Cat_Demonstrating_Dilated_Slit_Pupils.jpg), Cropped, https://creativecommons.org/licenses/by-sa/4.0/legalcode