Programming 2025
Competition Case

Presented by:

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1. General Rules

Duration

All teams shall complete the challenge within <TO BE SPECIFIED> hours. The start time will be announced to all competitors after the competition briefing and question period. The design period shall immediately commence upon the delivery of the competition case document. Updates on the time remaining will be announced **three (3) hours, one (1) hour, thirty (30) minutes, and ten (10)** minutes before the end of the allotted time through

Deliverables

As part of Programming 2025, the following deliverables will be required:

1. Code
2. Presentation

Code

All code must be in each team's specific GitHub repository's "main" branch before the 8-hour deadline in order for it to be considered for judging. Basic instructions must be provided in a README.md on how to compile and run your code. This includes:

- The language and version your code uses
- A list of required packages (i.e. Pandas, NumPy)

Any specifications of this sort not included in the README cannot be assumed to be on the Directors' machine(s).

All code and presentations should be submitted on or before the deadlines. Late submissions will not be accepted.

Presentation

The presentation file must be submitted in the specific GitHub repository's "Main" branch before the 8-hour deadline. The presentation itself must be submitted as a .pdf, .ppt, or .pptx file to prevent any changes from occuring after the end of the

design period. We recommend that teams reserve adequate time to submit the presentation given that technical difficulties may arise. Any modification of presentation content after the deadline is **strictly forbidden** and may subject a team to disqualification.

Presentation Schedule

The randomized presentation order will be released **thirty (30) minutes** prior to the first presentation through ..... (insert a link to discord) . Requests to switch presentation order will be declined to ensure fairness between teams.

Each team will have **twenty (20) minutes** to present their deliverables, **followed by a ten (10) minute question-and-answer period** with the judges. All team members **must** participate in the team's presentation.

2. Background

On August 7th 2023, Destiny Rennie, a young Mi'kmaq woman died tragically of fungal meningitis, a disease which causes inflammation in the brain and spine. Fungal meningitis has a mortality rate of 50% and should be treated at least within 24 hours of diagnosis. However on July 27th 2023, when Destiny entered Soldiers Memorial Hospital (Middleton, NS), she was prescribed antibiotics and sent home with a CT scan scheduled for the following day. After her symptoms continued to deteriorate, she was taken to the hospital by ambulance on July 31st. According to the PATH legal team "by August 2nd, doctors suspected meningitis and ordered treatment, but delayed administering it for 8.5 hours." She was finally airlifted to the QEII Hospital (Halifax, Nova Scotia), however by that time the "QEII doctors determined nothing could be done." Destiny's story is one of many examples illustrating the ramifications of overwhelmed hospitals and staff, and the impact that has on patient satisfaction.

With an aging population, and dealing with the aftermath of Covid-19, the current healthcare system is undergoing all time stress. Wait times for hospitals emergency rooms across Nova Scotia can range anywhere from 1-7 hours

depending on the location. Most hospitals run close to maximum capacity, putting stress on both the patients and health care workers. In order to circumvent this, attempts to automate the triage system as well as other important medical tasks have been made. Even after diagnosis, many patients can end up waiting upwards of 100 days for MRI or CT scans.

In the fall of 2024 the Nova Scotia Government pledged $42 million dollars to help implement AI tools in its health care system. The first stage of this project beginning in the fall of 2024 was used to increase information access to patients, regarding wait times and other aspects of supposed conditions. In the fall of 2025 the project aims to automate patient diagnosis for X-ray findings, in order to provide radiologists with preliminary imaging findings for chest X-rays. Using machine learning models to compare with thousands of anonymous images, this could be of great help in decreasing wait times for imaging services.

The new JBOW Hospital (Sexton Campus, NS), is taking a new stance on patient diagnosis. With the overwhelming amounts of patients requiring imaging, JBOW Hospital is in need of a program which can interpret MRI scans of the brain, to aid diagnosis and treatment for people undergoing brain injury. Using the grant given by the government, the JBOW Hospital is having a competition to decide which program to implement this idea. However developing these models can lead to unforeseen circumstances, where does the liability go when scans are interpreted incorrectly? Should the program favor earring on the side of caution when interpreting scans and risk wasting the doctors time? What role *should* automation and AI play in the medical field?

If you would like to learn more about Destiny Rennie's story, you can go through this CBC article.

3. Competition Challenge

Congratulations! JBOW Hospital has selected you as one of the select engineers to test and implement a modern program to help aid with our diagnosis and treatment of patients. For this challenge, we will require you to make a

program that can determine whether a brain tumor is present following an MRI scan. You have been given access to a database of thousands of brain images with the files located in the github repository, labeled “yes” and “no” depending on whether a tumor is present (“yes” means that there is a tumor and the brain is considered unhealthy while “no” would be considered the healthy brain).

In order to complete this challenge, you will need to create a way to process the images, and create a model which can detect if a tumor is present. To test your program, <To be specified number> random MRI images of the brain (both healthy and unhealthy) will be run through your program by the competition directors. Your program must correctly attribute whether a scan has a tumor and put the data into an excel or google sheets file. While not necessary for diagnosis, it would also be helpful if we could have specific information regarding the tumor, such as localization and classification in order to better inform treatment.

The success of your program will be based on the number of MRI scans that are accurately detected. However, more scrutiny will be applied to programs which fail to successfully diagnose the MRI scans which actually do have a tumor. The following truth table was created as a guiding factor to aid in the assessment in these scans:

Model Output (Probability)	**Class (Tumor/No Tumor)**	**Confidence of Tumor Present**
0.95	Tumor	High Confidence
0.80	Tumor	Considered Positive
0.75	Tumor	Lower Confidence
0.65	Tumor	Adjusted Threshold
0.55	Tumor	Adjusted Threshold
0.50	No Tumor	Traditional Threshold

0.45	No Tumor	Below Threshold
0.30	No Tumor	Low Confidence

Table 1: Truth Table

The GitHub general "main" repository has an example template for an expectation of data output on an excel sheet, however, this template does not have to be strictly followed. This can be found in the info folder!

4. Objectives

Main Objective:

You will have **8 hours** to complete this competition. At the 8 hour mark, all deliverables must be submitted. Any changes made to the main branch of your specific repository after the deadline will not be considered part of your submission.

Code

- All code must be in the specific GitHub repository's "Main" branch before the 8-hour deadline in order for it to be considered for judging.
- Codes must be opened from the competitors' laptops using the ones submitted on GitHub to ensure the software is downloaded properly and ensure fairness between the groups.
- Only code submitted by the deadline will be tested. Last modified time will be checked before the testing period. Any modifications are strictly forbidden.
- Basic instructions must be provided in a README.md on how to compile and run your code. This includes:
    - The language and version your code uses.
    - A list of required packages (i.e. Pandas, NumPy).
    - Any specifications of this sort not included in the README cannot be assumed to be on the Directors' machine(s).

- Algorithms and Interface: //we can provide the excel sheet, or ask them to create their own
    - Algorithm
        - Your algorithm must successfully detect the brain tumor for the test images and output the data into a file.
        - Any model should be trained within the time allotted. (We can change this if we train it for them to: Any model should have the instructions to train before the presentation period).

Presentation

- Presentation
    - Only presentations submitted in the provided GitHub repository's "Main" branch before the 8-hour deadline will be used in presentations to the judging panel. No work may be done on the presentation after the deadline has passed.
    - Your presentation must outline:.
        - The ethical considerations you took into creating your code.
        - The way you made use of the data provided. (Did you make use of all 20,000 images?)
        - The design and implementation of your algorithm.
    - Presentations can be opened from the computer programming directors' laptops using the files submitted beforehand - no last-minute changes allowed.

- Demo
    - You will be expected to give a short demonstration of how your program works.
    - The program will be loaded on one of the Director's machines and must run on it. You can assume the Directors have installed any languages and packages you have specified in a README in your submission. Be sure that your instructions to compile and run your code are detailed enough for the Directors to set up your program.

5. Judging and Scoring

The judges will be using the following rubric to evaluate the scores of each team. This matrix will determine how well your team meets the objectives and requirements of the design challenge and ultimately, the top contending teams. The judging matrix, and **all generic competition rules** can be found in the CEC 2025 Rule Book.

* The general desired outcome would be for each team to create a model which can process the images and assess them with at least 50% accuracy.

Evaluation Rubric

Category	Sub-Item	Evaluator	Weight
Strategy and Algorithm	1. Simplicity 2. Ingenuity 3. Ability to Achieve Desired Outcome*	Judges	/5 /10 /20
Code	1. Structure 2. Consistency 3. Readability 4. Efficiency	Judges	/5 /10 /5 /10
Data Output	1. Ease of Use 2. General Aesthetics 3. Creativity	Judges	/5 /5 /5
Presentation	1. Design Process and Justification 2. Design Critique 3. Body Language, Respect and Professionalism 4. Visual Aids 5. Response to Questions	Judges	/7 /4 /4 /2 /3
Bonus	1. Most Correct Data Output	Directors	/10

Penalties	See the below penalties matrix.	Judges	
Total			**/100**

Penalty Matrix

Scoring Penalties	
Plagiarism	**Elimination**
School or Regional Apparel During Presentation	**Elimination**
Documents Received After Deadline	**-50 points per instance**
Absent Team Member	**-25 points per instance**
Entering Presentation Room Before Allotted Time (after first offense)	**-10 points per instance**
Disclosure of School or Region in Presentation Files/Documents	**-10 points per instance**
Verbal Disclosure of School or Region During Presentation	**-10 points per instance**
Hints provided	**-5 points per hint**

6. Communications and Language

Q&A

Only the Programming Directors shall be permitted to answer questions on behalf of the CEC Programming challenge during the competition period. All questions and inquiries along with their responses will be posted publicly to the <Discord link> in the CEC Discord, in both English and French. Questions may be asked up until time or end of the challenge.

Technical Assistance

To ensure fairness, the Programming Directors have developed multiple documents in GitHub that will assist in technical matters. If that does not suffice, teams may additionally request help from Programming Directors to help with issues which are strictly technical issues in nature.

Programming Directors reserve the right to refuse assistance or questions if they believe that it poses an unfair advantage to other teams, or that the question asked may disrupt the integrity of the competition.

Presentation Language

Teams can choose to present in either **French** or **English**. To ensure fairness and due to limited translation resources, teams must indicate if they will speak **English or French** for any amount of their presentation at check-in on the first day of competition.

For teams that select **French** as their presentation language, professional live-interpretation services will be provided to judges who are not bilingual during the presentation.