Canadian Engineering Competition 2025

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Programming Competition

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Agenda

- Choice of Language
- Background and Challenges
- Scoring Metrics
- Logistics and Timeline
- Presentations
- Questions

Choice of Language

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Choice of Language

Competitors may present in English or French

- Throughout the design period, questions should be submitted either on the Discord channel specific for programming or in person.
- Questions will be responded to in english on the Discord channel.

Background and Challenge

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Background

Background

- On August 7, 2023, Destiny Rennie, a young Mi'kmaq woman, passed away tragically from fungal meningitis, a disease with a 50% mortality rate.
- Missteps in her treatment timeline at Soldiers Memorial Hospital (Middleton, NS) and the subsequent delay in treatment led to her death.

Healthcare Challenges Highlighted

- Overwhelmed hospitals and medical staff.
- Long emergency room wait times in Nova Scotia (1-7 hours).
- Critical delays in diagnostic imaging, with waits of over 100 days for MRI/CT scans.

Background

Government Response and Technological Innovation

- In Fall 2024, the Nova Scotia Government allocated **$42 million** to implement AI in healthcare:
- **Stage 1 (2024):** Increase patient access to information (e.g., wait times).
- **Stage 2 (2025):** Automate preliminary imaging diagnostics for X-rays, using machine learning to analyze thousands of anonymized images.

The Role of JBOW Hospital

- JBOW Hospital at Sexton Campus, NS, seeks to transform imaging diagnosis for brain injuries.
- A competition is underway to develop a program capable of interpreting MRI brain scans to aid diagnosis and treatment.

Background

Key Questions and Ethical Considerations

- Liability in case of incorrect AI-based diagnoses.
- Balancing caution in AI interpretation against wasting medical resources.
- Defining the role of automation and AI in the medical field.

Challenge

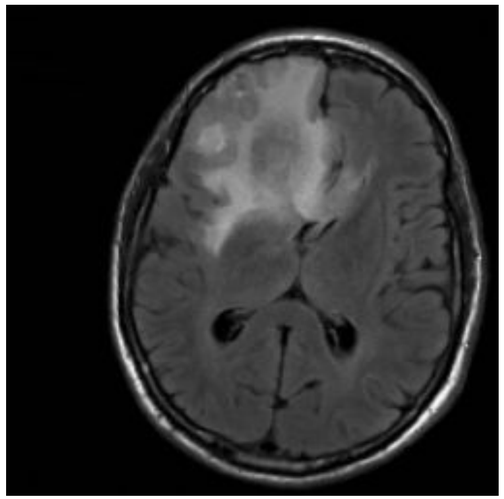
Objective

- Develop and implement a modern program to aid JBOW Hospital in diagnosing and treating patients with brain tumors.
- The program must determine whether a brain tumor is present in MRI scans.
- In the testing period, 1000 images will be run through your program. Your program will be tested for accuracy.

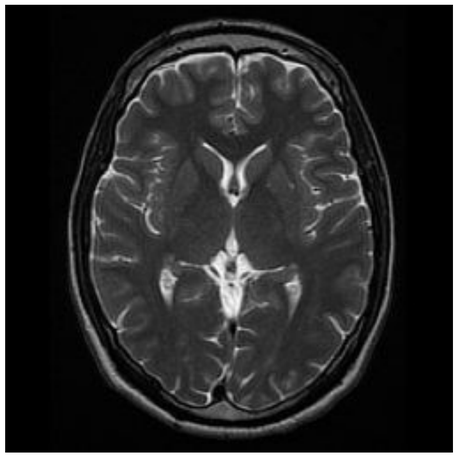
Challenge

Resources Provided: Access to a comprehensive database of thousands of labeled MRI brain images

"**Yes**": Tumor present (Unhealthy Brain)

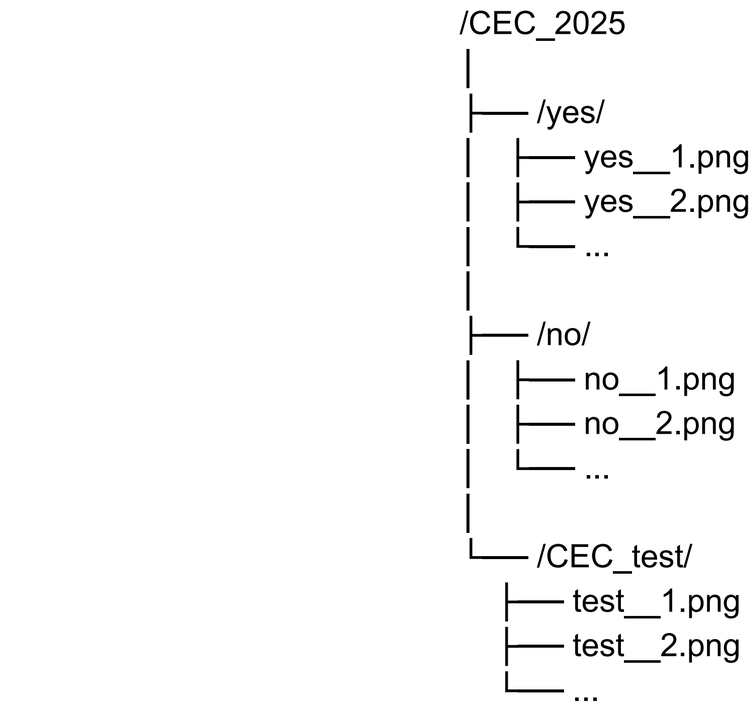


"**No**": No Tumor (Healthy Brain)



Challenge

- The dataset downloaded has the following directory structure:



Challenge

Challenge Requirements

1. **Image Processing:**
   a. Analyze MRI Scans and build a detection model.
2. **Accuracy Testing:**
   a. Competition directors will test the program with a set number of random MRI images (healthy and unhealthy).
   b. Output results must classify scans as “yes” or “no” and export data to Excel or Google Sheets.
3. **Optional Feature:**
   a. Include tumor localization and classification to support treatment planning.

Deliverables

- A program that achieves reliable tumor detection.
- Accurate and organized data presentation in spreadsheet format.

Challenge

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

Setting Up Environment Variable

- Use of environment variables makes testing more efficient
- Instructions on how to configure this can be found in GitHub
- Environment variable name must be ‘CEC_2025_dataset’

Example of how to implement (Python)

```
import os

# Get the path to the folder from the environment variable
dataset_folder = os.getenv('CEC_2025_dataset')
```

Testing: Code Specific File Downloads

- If your code requires specific files for model data (e.g., model weights stored in HDF5, Pickle, JSON format, etc.), please specify these dependencies in the README file.
- Uploading large files to GitHub may cause delays. You can use public OneDrive, Google Drive links or other services for access
- Teams will face penalties ranging from elimination to -5pts depending on severity if files are not uploaded on time (file modification dates will be checked for on OneDrive and Google Drive).

Testing

Test Images:

a. Located in the 'CEC_test' folder with files named 'test_xxx.png' (where 'x'' is the test number). The directors have assigned 'yes' or 'no' values to these images in a separate file.

Testing Script:

b. Must reference the folder at /CEC_2025/CEC_test. This can be done by setting environment variable CEC_2025_dataset to the folder path on your system.

Result Output:

c. Results should be exported as a .csv, .xlsx, or Google Sheet. Raw results are necessary for testing.

CSV File Format: Your output should include:

- **1st Column**: Test image name
- **2nd Column**: Result ('yes' or 'no')

Testing

Example Output CSV:

Image	Tumor present?	
test_1.png	yes	
test_2.png	no	
test_3.png	yes	
test_4.png	yes	
test_5.png	no	
test_6.png	no	
test_7.png	yes	
test_8.png	yes	

Example of Test in Excel:

Image	Tumor present?	Competitor Results:		LEGEND		DATA ANLYSIS	
test__1.png	yes	yes		yes		Correct right:	Percent right:
test__2.png	no	no		no		510	51%
test__3.png	yes	yes					
test__4.png	yes	no					
test__5.png	no	yes					
test__6.png	no	yes				Number of tumors:	Number of no tumors:
test__7.png	yes	no				511	489
test__8.png	yes	yes					

Scoring Metrics

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Judging Structure

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 /5 /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	/5 /5 /5 /5 /5
Bonus	1. Data output with accuracy >=95%	Directors	+5
Penalties	See the below penalties matrix.	Judges	
Total			**/100**

Penalties

Scoring Penalties	
Plagiarism	**Elimination**
School or Regional Apparel During Presentation	**Elimination**
Disclosure of School or Region in Presentation Files/Documents	**Elimination**
Verbal Disclosure of School or Region During Presentation	**Elimination**
Documents Received After Deadline	**-50 points per instance**
Absent Team Member	**-25 points per instance**
Failure to hit minimum benchmark of 65% accuracy	**-10 points**
Entering Presentation Room Before Allotted Time (after first offense)	**-10 points per instance**
Late model files submission (extreme extenuating circumstances)	**-5 points per instance**

Code Demonstration

Expectations

- Provide a short demonstration showcasing the functionality of your program.

The program will be tested on one of the competition Director’s machines.

Technical Setup

- Directors will pre-install any languages and packages specified in your submission's README file.

Submission Guidelines

- Ensure the README includes clear, detailed instructions for:
  - Compiling the code.
  - Running the program successfully.

Logistics and Timeline

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Competition Case

- The competition case document and all other necessary documents will be sent in a GitHub Repository by email at 9:00 am AST.
- You will have 8 hours to complete all deliverables.
- ANY DELIVERABLES PUSHED TO YOUR REPOSITORY BRANCH AFTER 5:30 pm AST WILL NOT BE CONSIDERED!
- The push closest to and preceding the deadline will be taken as your submission.
- All questions are recommended to be posted on the programming discord channel.

Time Warnings

- The following time warnings will be posted on Discord during the design phase:

- 3 hours before the deadline
- 1 hour before the deadline
- 30 minutes before the deadline
- 10 minutes before the deadline

Deliverables (Code)

Submission Guidelines

- All code must be uploaded to the Main branch of the provided GitHub repository before the 8-hour deadline.
- Only code submitted by the deadline will be judged.
- The last modified timestamps will be verified.
- Modifications after submission are strictly prohibited.

Fairness Measures

- Code will be downloaded and tested from GitHub on Directors laptops to ensure fairness and verify proper repository usage.

Deliverables (Code)

README Requirements

- Include clear instructions on how to compile and run your code:
- Specify the programming language and version used.
- List required packages (e.g., Pandas, NumPy).
- Any missing specifications will not be assumed to be pre-installed on Director machines.

Algorithm and Output Expectations

- Your algorithm must:
  - Detect brain tumors in the provided test images.
  - Output results to a file (e.g., Excel or Google Sheets).

Deliverables (Presentations)

Submission Guidelines

- Presentations must be submitted to the Main branch of the provided GitHub repository before the 8-hour deadline.
- No modifications to the presentation are permitted after the deadline.

Content Expectations

Your presentation should address the following:

- **Ethical Considerations:**

Detail the ethical principles applied during the creation of your code.

- **Data Utilization:**

Explain how the provided data was used (e.g., extent of use of all images).

- **Algorithm Design and Implementation:**

Describe the process and structure of your algorithm.

Deliverables (Presentations)

Logistics

- Presentations will be accessed and opened from the Directors’ laptops using the pre-submitted files.
- Last-minute changes or additional work are strictly prohibited.

Deliverable Submission

- All deliverables must be pushed to your team's MAIN OR MASTER branch on your GitHub repository before 5:30 pm AST.
- Any pushes with timestamps after 5:30 pm will not be taken into consideration.
- Please make sure to add @joyaa16 and @OrionWiersma as collaborators to your repository on GitHub.

Plagiarism

- All previously written code approaches found online, and references must be cited in comments within your code and/or in your presentation.
- Use of AI must be cited!
- Citations should follow IEEE standard format!
- A copy of important prompts and responses from any generative AI tools is suggested (ChatGPT, Gemini, Bing Ai, etc.).

Presentations

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Presentation Order

- The order of presentations will be posted tomorrow at 8:30 AM AST on the Discord channel, 30 minutes before the first presentation.
- All teams must be prepared to present when the presentation order is announced.
- Requests to switch presentation orders will be declined to ensure fairness between teams.

Presentation Rules

- Competitors will have a maximum of 20 minutes to present their solutions and demonstrations.
- All team members must be present and participate.
- Your program and presentation will be run on one of the Directors' machines, using the version submitted on GitHub prior to the deadline on Saturday.
- Judges will have 10 minutes to pose questions afterwards.

Presentation Outline

- Your presentation should include a brief description of your code, and the algorithms you chose to design/implement.
- The ethical considerations needed to take while designing your code.
- How you made use of the dataset.
- Troubleshooting (if any required).

Time Warnings

- Time is stopped when a question is being answered during the 20 - minute presentation period
- You will be notified:

10 minutes, 5 minutes, and 1 minute before the end of the 20 - minute presentation period.

- A single table knock will be made when there is one minute left.
- There will be a countdown for the last 15 seconds of the presentation.
- Judges and presenters will be given a countdown during the last 30 seconds of the total presentation period.

Accessibility

- If you have any accessibility needs, please inform us as soon as possible.
- French presentations will be interpreted by live professional interpreters.

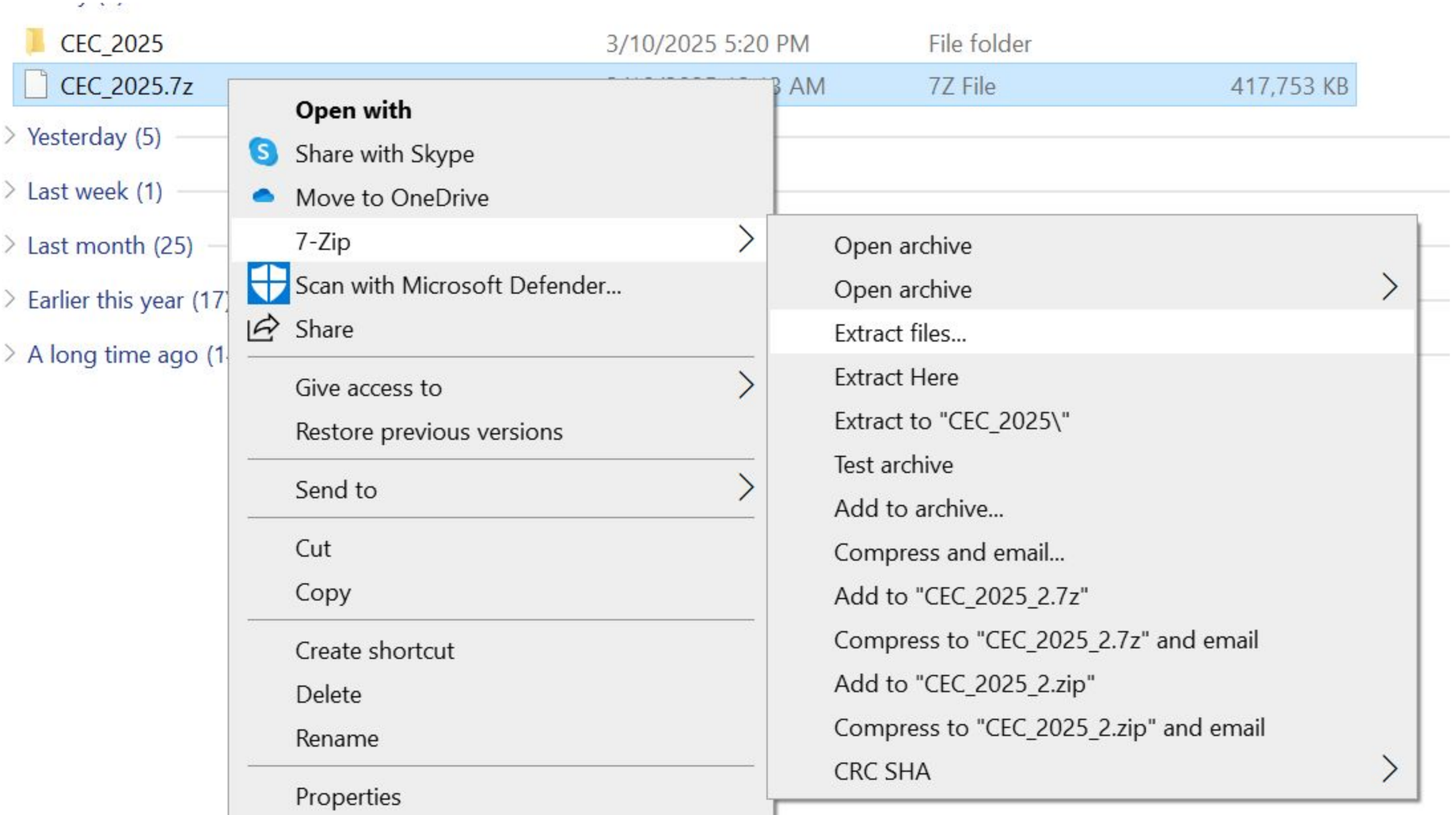
Room Assignments

- You will be informed of the room you are assigned to right after the presentation.

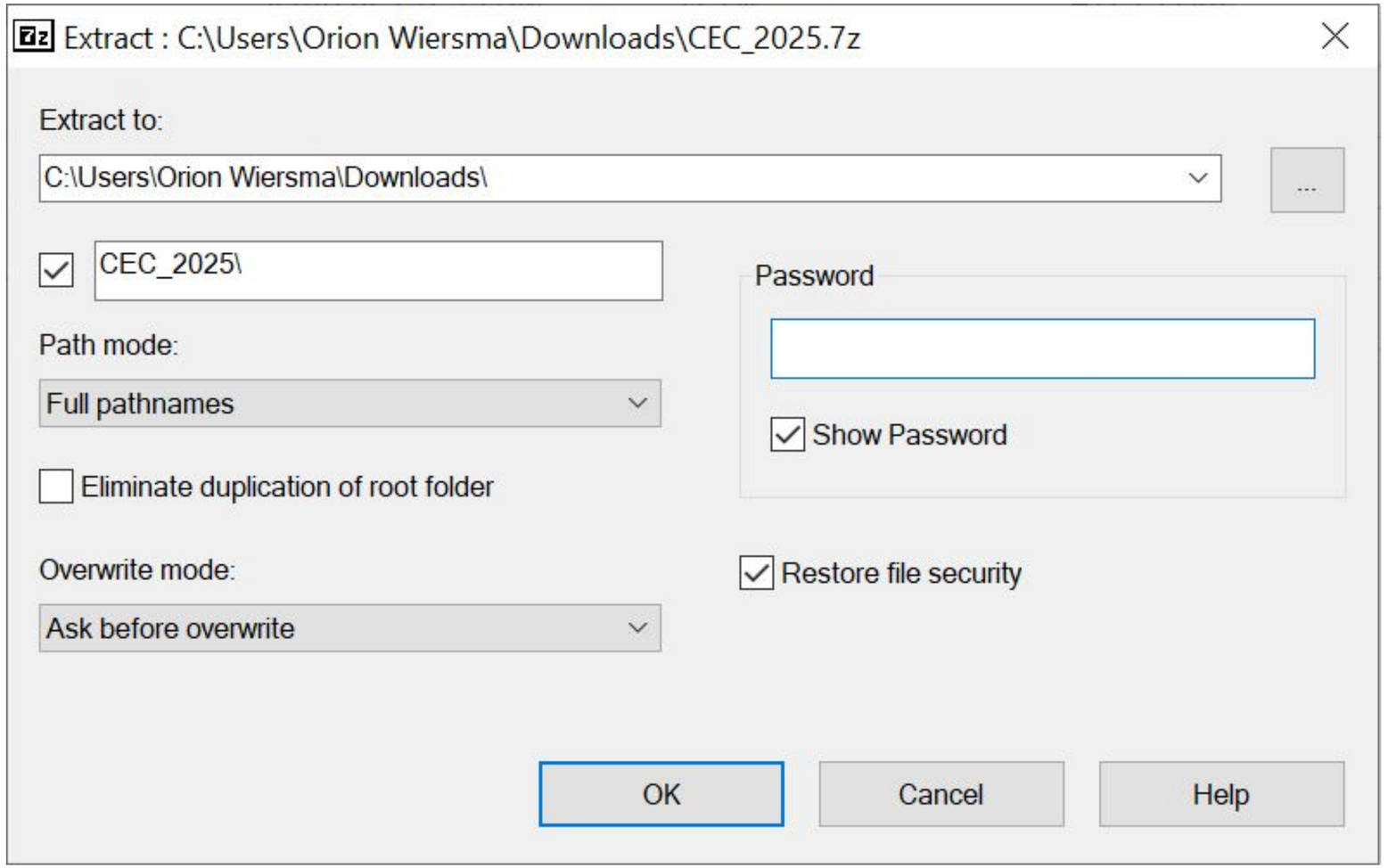
Questions

- All questions are encouraged to be posted on the Questions channel on Discord. The full question and answer will be posted in english for all teams to see within 10 minutes of the question being asked.
- If a question is sent via private message or email, it will not be answered.
- If answering a question is deemed to be unfair or compromises the integrity or spirit of the competition, the question will be posted in English with No Comment as the answer.

Access Dataset



Access Dataset



Thank you!

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Thank you!

Please do not leave the room until dismissed.

If you have any questions, please send them to the Discord.

10-MINUTE QUESTION PERIOD!

All answers to these questions will be posted on Discord as well!