

Hackathon Game Track: Neuromancer

Transforming VR to BCI Gaming

Overview

This track serves as an innovative blend of neuroscience and gaming in the hackathon. Brain-Computer Interface (BCI) gaming is at the cutting edge of interactive entertainment, enabling players to control game mechanics using their brain signals. This task challenges participants to transform a provided first-person shooter VR game into a fully functional BCI-enabled game, incorporating Motor Imagery (MI), Steady-State Visually Evoked Potentials (SSVEP), and Electromyography (EMG) as control mechanisms.

Game Repository: <https://github.com/Mio0v0/NeurealityGameTrack>

Objective

Capture and Preprocess BCI Signals: Utilize the tools we provide to capture and preprocess brain-computer interface (BCI) signals.

Decoder Development: Considering the time constraints, it's understandable if you cannot incorporate all three modalities into the final game. Aim to develop decoders for all three, but include only the ones you are confident with in the final product.

Integration of BCI Modalities: Ensure smooth integration of decoders into the game, allowing reliable translation of brain and muscle signals into actions. Focus on communication between the decoder system and the game for quick, accurate responses.

User-Friendly Gaming Experience: Endeavor to design the game to be as user-friendly as possible, featuring intuitive BCI controls. Focus on simplifying the interface and interactions to ensure they are easy to understand.

Deliverables

Code Repositories: Submit a link to a public repository (e.g., GitHub, Bitbucket) with the complete source code for the BCI-enabled game. This includes all custom scripts and libraries. Ensure the repository has a detailed README file with instructions for setting up, installing, and running the game. Highlight how you implemented BCI technologies.

Fully Functional BCI-Enabled Game: Provide a complete, playable version of the first-person shooter VR game, now with BCI functionality. It should incorporate at least one of the following

for game controls: Motor Imagery, SSVEP, or Electromyography (EMG). Include instructions for download or access, and a user guide for BCI input navigation.

Demo Video: Create a demo video showing your game in action, focusing on player interaction with BCI controls.

Technical and Design Documentation: Submit a comprehensive document detailing your game's technical architecture, the rationale behind your BCI modality choices, and your integration strategy. Include an analysis and description of your efforts with decoders not featured in the final game, documenting both the testing process and the insights gained.

Judging Criteria

Submissions will be evaluated based on the following criteria:

Effort and Exploration: Evaluation will acknowledge the diligence in attempting to include, develop, and test various decoder types, irrespective of the actual number incorporated into the final product.

Actual Implementation and Effectiveness: The evaluation will also focus on the decoders that are ultimately integrated into the final game, examining the diversity and types of decoders used. Additionally, their effectiveness, in terms of responsiveness and precision in converting brain signals to game actions, will be assessed.

Integration and Compatibility: The effectiveness of the decoder system's integration into the game and the quality of its communication design are being evaluated. This includes assessing how smoothly the decoders function together to deliver a cohesive gaming experience.

User Experience and Usability: The overall enjoyment and engagement of the game, including how interesting and fun it is to play, alongside player comfort during gameplay, will be assessed. This evaluates the game's ability to captivate and maintain player interest while ensuring ease of use and accessibility.

Innovation: The originality and creativity of the solution, including the inventive ways BCI is integrated into VR gaming, are evaluated. Thoughtful and considerate modifications to the original game to optimally adapt it for BCI purposes are also taken into account, highlighting creative adjustments that enhance the fit between the game and BCI technology.

Recommended Skills

To tackle this challenge successfully, participants would benefit from the following skills:

Programming: Proficiency in languages such as Python or C++ for game development and BCI integration.

Brain-Computer Interface (BCI) Knowledge: Understanding of BCI systems and experience in signal processing to capture and interpret brain signals.

Game Development: Familiarity with platforms like Unity or Unreal Engine for creating and modifying the VR environment.

User Interface/User Experience Design: Skills in UI/UX design principles to make the game accessible and enjoyable.

Collaboration and Problem-solving: The ability to work well in a team and tackle technical challenges creatively and efficiently.

Required Hardware/Software

OpenBCI Cyton: Captures EMG signals for weapon control. Organizers will provide this for the duration of the event.

g.tec Unicorn EEG Cap: For detecting SSVEP and MI signals for AOE and special attacks. Organizers will provide this for the duration of the event.

Oculus 2 Headset: The designated VR platform for the challenge. Organizers will provide this for the duration of the event.

g.tec Unicorn Unity Prefab: This prefab will be provided to participants by the organizers.

Unity: The game development platform to be used. Free version available, but participants must download it themselves.

Physiolab XR: This software will be provided to participants by the organizers.

Recommended Equipment

OpenBCI + Physiolab XR

Unicorn + Physiolab XR

Unicorn + g.tec Unity Plug in

Resources

A tutorial on setting up the Unicorn Unity Interface in a new project is available here:

<https://youtu.be/p4rZTcaegx0>

VR Game Setup and Documentation

<https://docs.google.com/spreadsheets/d/11BxwZHgbkQkXQ6W92JWUIUVH5eCfvYXXa4r7-JKuJP8/edit?usp=sharing>

PhysioLabXRDocs 1.0.0 documentation

<https://physiolabxrdocs.readthedocs.io/en/latest/>

Team Composition

For optimal team composition, consider the following recommendations:

Team Size: Ideally, 3-5 members to ensure a diverse skill set without complicating coordination.

Mix of Skills/Roles:

At least one Developer proficient in programming (Python, C++, Unity).

A Designer familiar with game development, with experience in UI/UX design being a plus.

An Engineer or Scientist with knowledge in BCI technologies and signal processing (familiarity with OpenBCI, EEG data analysis).

A Project Manager or Coordinator to oversee the project timeline, tasks, and team communication.

Incorporating a mix of these roles will enable your team to effectively tackle the challenge, from concept to completion.

Mentorship and Support

Mentors will be available during the hackathon. Please check the mentor channel on Slack and request mentorship if needed.

Timeline

Friday Evening (Day 1):

Kickoff Meeting: Introduction and overview of the challenge rules, objectives, and resources.

Team Formation: Finalize teams and discuss initial ideas.

Initial Planning: Outline project scope, assign roles, and set milestones.

Saturday (Day 2):

Morning Check-In: Brief team meeting to discuss progress and adjust plans as necessary.

Development Time: Focus on building the core functionalities of the BCI-enabled game.

Afternoon Workshop: Optional session on BCI technologies or Unity development.

Evening Check-In: Assess progress, troubleshoot issues, and plan for the next day.

Sunday (Day 3):

Morning Sprint: Prioritize remaining tasks and focus on integration and testing.

Midday Review: Evaluate game functionality, user experience, and prepare for final adjustments.

Final Push: Complete any last-minute enhancements and finalize project documentation.

Submission Preparation: Ensure all deliverables are in order, including the game prototype, demo video, and documentation.

Monday Morning (Submission Day):

Final Submissions Due: Submit all project materials by the specified deadline.

Judging Begins: Evaluation of submissions based on criteria outlined in the challenge.

FAQ Section

1. What level of programming proficiency is required?

A certain level of proficiency is necessary because the challenge spans only three days. Participants should be comfortable with Python, C#, and Unity to efficiently work on the project.

2. How will teams access the required hardware?

The required hardware will be provided by the organizers for the duration of the event.

3. What if we're new to BCI or game development?

We will provide guidelines and a workshop on how to create BCI-enabled games. Additionally, a recording of a game development workshop will be available on our website for those who want to learn at their own pace.

4. Are there any specific requirements for the demo video?

There are no stringent requirements for the demo video, but it should be limited to three minutes. It should showcase the entire gameplay process, including the scoring system and any game mechanics incorporated.

5. What support is available during the hackathon?

Participants will have access to mentors and scheduled check-ins for support. Additionally, online forums and chat groups will be set up for real-time troubleshooting and guidance.

6. How detailed should the technical and design documentation be?

The documentation should cover the technical architecture, the choice of BCI modalities, integration strategies, and any challenges faced. It should be detailed enough to provide a clear understanding of your project and process.

7. Can we use additional tools or software not listed in the requirements?

Yes, you are encouraged to use any additional tools or software not listed in the requirements as you see fit to enhance your project.

8. Can we make changes to the current VR game?

Yes, you are allowed to make modifications to the existing VR game as long as they are well-documented. Enhancing the game to better suit BCI development is encouraged; however, we recommend not focusing excessively on altering the game's core. Instead, prioritize making the BCI integration as playable and user-friendly as possible.

9. How can we familiarize ourselves with the current VR game that will be provided?*

The VR game along with its documentation and resources will be provided to you. You will receive a link to access these materials, allowing you to review, play around with the game, and understand its mechanics and underlying code.

Contact Information

Slack

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