

PHOENIX 13

OPEN INNOVATION IN EDUCATION





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Welcome To Learners'Ed

Quality education is the path to transcendence. However during the recent difficult times, one of the fields that suffered with a major setback was education. Students had to attend schools from their homes missing out on their peer learning and a healthy competitive environment. To solve this problem and provide students with an even better learning environment from their homes as well, we have introduced our project, Learners' Ed.

The further slides would be covering more about the other modules.

Project Name:

Learners'Ed (oneDNN & OpenMP Optimized Models)

Team Name:

Phoenix 13

Team Members:

Sanjay Kulshrestha (Professional Member)

Saumya Srivastava (Team Leader)

Sujal Kulshrestha



Open Innovation in Education




The education sector is facing numerous challenges in the wake of the COVID-19 pandemic. One of the significant challenges is the need for innovative solutions to address the disparities in student learning outcomes and to ensure equitable access to quality education. To tackle this challenge, we are calling for an open innovation challenge that leverages the Intel® AI Analytics Toolkits, its libraries, and the SYCL/DCP++ Libraries to develop innovative solutions to improve student learning outcomes and promote equitable access to quality education.

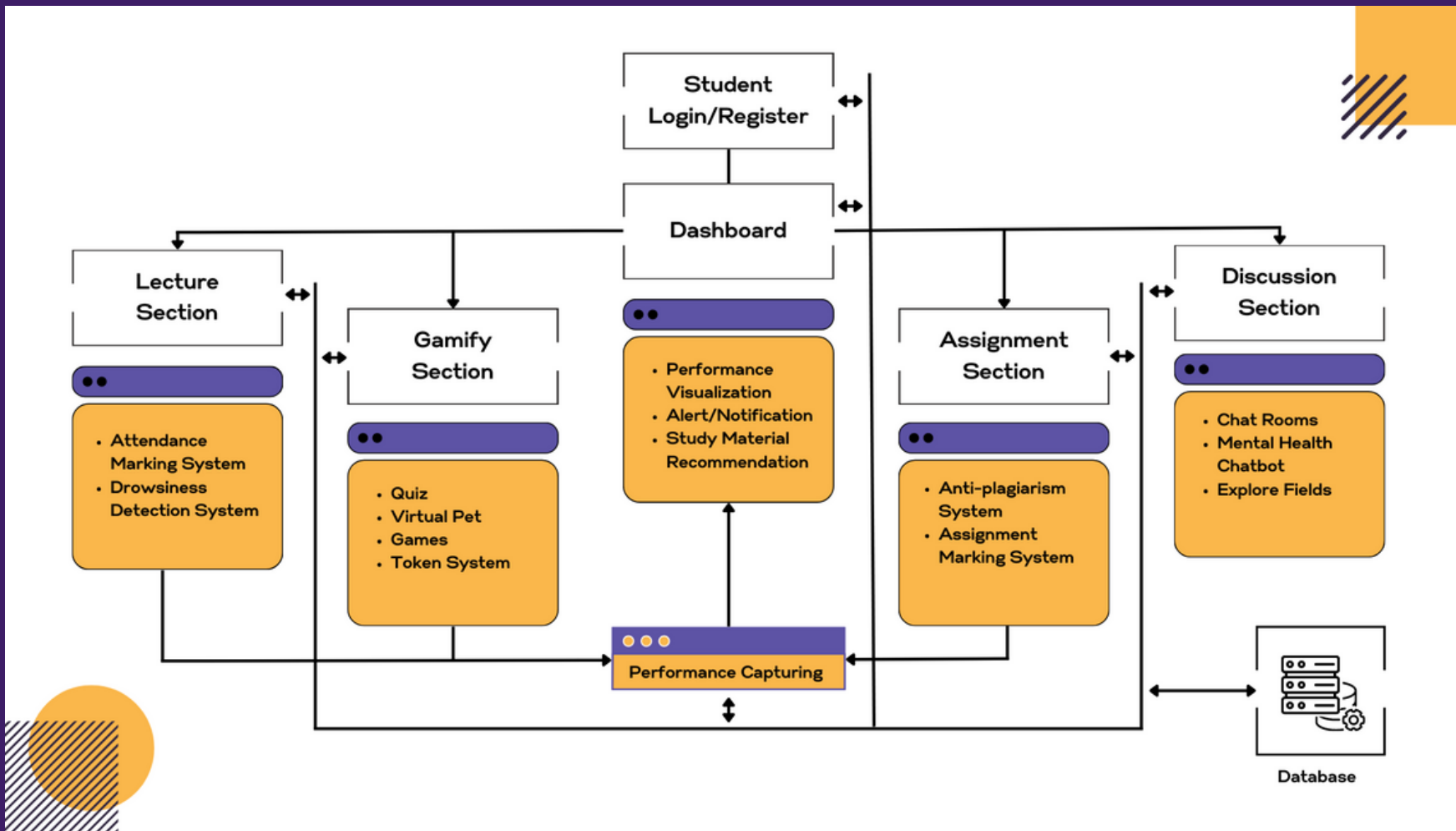
End Goal

The ultimate goal of this open innovation challenge is to create innovative solutions that leverage the [Intel® AI Analytics Toolkits its libraries](#) and the SYCL/DCP++ Libraries to improve student learning outcomes and promote equitable access to quality education.

Note: To achieve optimal performance and better models, it is required to use the [Intel® AI Analytics Toolkit its libraries, and the SYCL/DCP++ Libraries](#) to develop the interactive educational platform. Therefore, participants are advised to leverage the libraries and optimizations provided by oneAPI to enhance the efficiency of the application.



ARCHITECTURE DIAGRAM



To meet the project requirements, we have developed three sophisticated Deep Learning Models that play crucial roles in different sections of our platform. These models have been enhanced with Intel oneDNN and OpenMP optimization, allowing us to achieve exceptional performance gains, including faster training, higher throughput, improved inference speed, and reduced latency.

The first model we have developed is the Drowsiness Detection Model, which is utilized in the Lecture Section. By leveraging Intel oneDNN and OpenMP optimization, we have significantly accelerated the training process of this model. This optimization framework has not only expedited the training phase but has also improved the overall inference speed during real-time drowsiness detection. As a result, students' attendance can be accurately determined based on their active listening time during lectures.

Learners'Ed Education Platform

Our web-based education platform includes several key features:

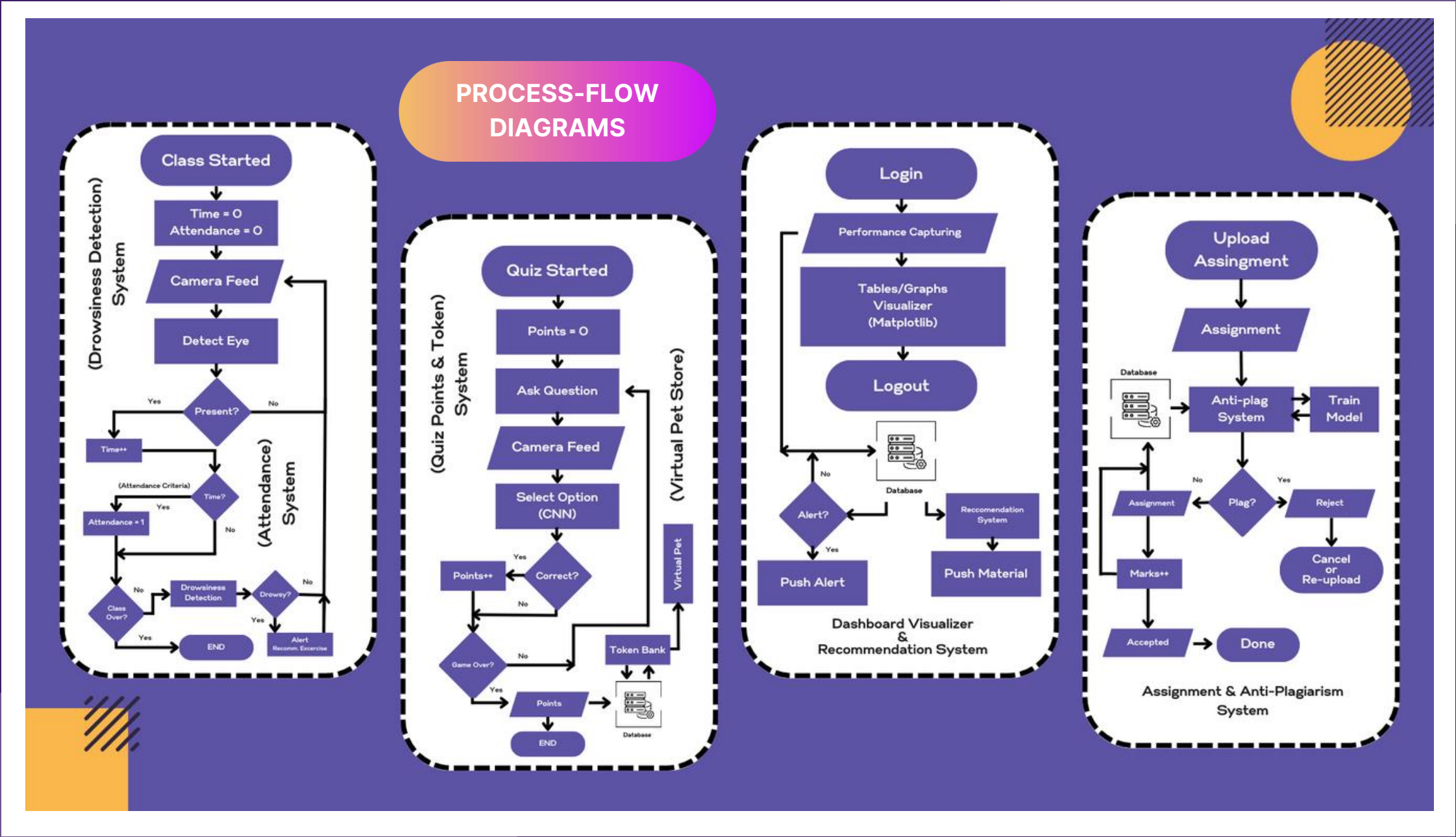
- **Dashboard Section:** Provides students with their school rank, performance graphs, attendance, and activity. It also includes an alert section for important notifications.
- **Recommendation System:** Generates YouTube video links based on student interests recorded from favorite category selected by student at the time of registration.
- **Drowsiness Detection System:** Tracks students' active listening time during uploaded lectures to determine attendance.
- **Plagiarism Checker:** Identifies instances of plagiarism in submitted assignments and prompts students to resubmit their work to ensure academic integrity.
- **Gamify Section:** Offers interactive learning experiences, including a quiz system that uses facial movements and gestures for answering questions. Students can also choose and name virtual pets, earn Learners'Ed coins, and improve pet ranks by participating in quizzes.
- **Mental Health Chatbots:** Provides students with a supportive chatbot system to address loneliness and promote mental well-being.
- **Chatrooms:** Facilitates peer-to-peer interaction, academic discussions, question-solving, and project collaboration.
- **Explore Fields Section:** Shares trending global videos and news to keep students updated and encourage exploration of new interests.

These features enhance the learning experience, foster engagement, and address various aspects of students' educational and emotional needs.

The second model we have incorporated is the Face Pose Estimation Model, which plays a crucial role in the Gamify Quiz section. Through the implementation of Intel oneDNN and OpenMP optimization techniques, we have achieved remarkable improvements in training efficiency, throughput, and inference speed. These optimizations have enabled us to accurately estimate facial movements and gestures during the quiz, providing an engaging and interactive learning experience for students.

Lastly, we have developed a sophisticated Mental Health Chatbot that leverages Intel oneDNN and OpenMP optimization. This optimization framework has significantly enhanced the performance of our chatbot, resulting in faster response times, improved throughput, and reduced latency. By employing Intel's optimization tools, such as scikit-learn-intelx, we have been able to train the chatbot model efficiently and deliver prompt and insightful responses to students seeking support.

The integration of Intel oneDNN and OpenMP optimization in our models has been instrumental in achieving remarkable performance enhancements. The collaboration between our deep learning models and Intel's optimization tools has resulted in faster training processes, higher inference speeds, and improved overall efficiency. These optimizations have enabled us to deliver a seamless and efficient educational experience to our users while ensuring the highest quality standards.



Performance Booster

(CORE COMPONENTS)

List of oneAPI AI Analytics Toolkits & its libraries used

Intel oneAPI Base Toolkit (General Compute)

- Intel® oneAPI Data Analytics Library
- Intel® oneAPI Deep Neural Networks Library
- Intel® Distribution for Python
- Intel® oneAPI Math Kernel Library

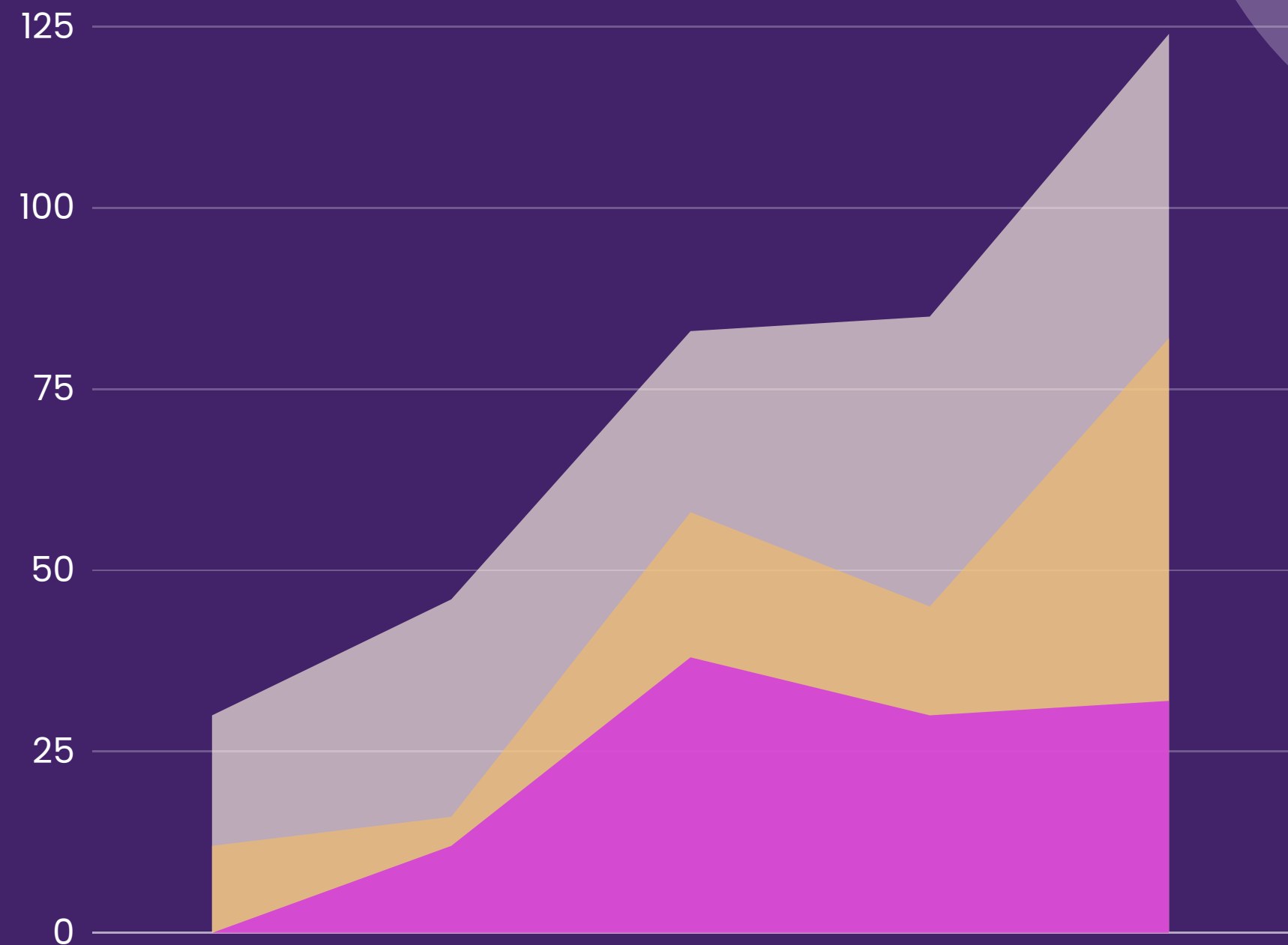
Intel® AI Analytics Toolkit

(End-to-End AI and Machine Learning Acceleration)

- Intel® Distribution for Python with highly optimized scikit-learn
- Intel® Optimization for TensorFlow
- Intel® Optimization of Modin

Base Technology Stack

- HTML & CSS – Web Application (Frontend)
- Tailwind CSS – (Style)
- Django – Web Application (Backend)
- Javascript – Validation & Client-Side Scripting
- MongoDB & Sqlite3 – DBMS
- Matplotlib & Seaborn – Data Visualization
- Google Charts, Charts.js and/or any other 3rd Party – Data Visualizer
- TensorFlow & scikit-learn (scipy) – DL and ML Model
- OpenCV – Computer Vision



These oneAPI Toolkits & Libraries gave us a major performance boost in all of our Deep Learning Model Training.

Specially oneDNN with OpenMP, scikit-learn extension & Modin for Pandas

Note: We have trained our model using intel oneAPI AI analytics toolkit oneDNN and OpenMP on intel i5 11th gen 11260H 6 core 12 thread computer.

Intel oneDNN (Deep Neural Network Library) is a highly optimized library that provides efficient implementations of deep learning primitives. By utilizing Intel oneDNN, our three models benefit from accelerated training, improved throughput, enhanced inference speed, and reduced latency. The library's optimized computations and parallelization techniques optimize the performance of our models, enabling faster and more efficient processing.

OpenMP is an industry-standard API that allows for parallelization of code across multiple processors. With OpenMP, we can leverage multi-threading capabilities to distribute computations among multiple cores or processors, maximizing performance and speeding up training and inference processes for our models.

This parallelization significantly improves the overall efficiency and scalability of our models.

Modin for Pandas is a powerful library that enhances the performance of Pandas, a popular data manipulation and analysis tool. By integrating Modin, we can scale Pandas operations across multiple processors or nodes, enabling faster data preprocessing and manipulation. This acceleration in data handling benefits our models by reducing the time required for data preparation, leading to quicker model training and improved overall efficiency. scikit-learn (sklearnex) is a widely used machine learning library that provides various algorithms and tools for tasks such as classification, regression, and model evaluation.

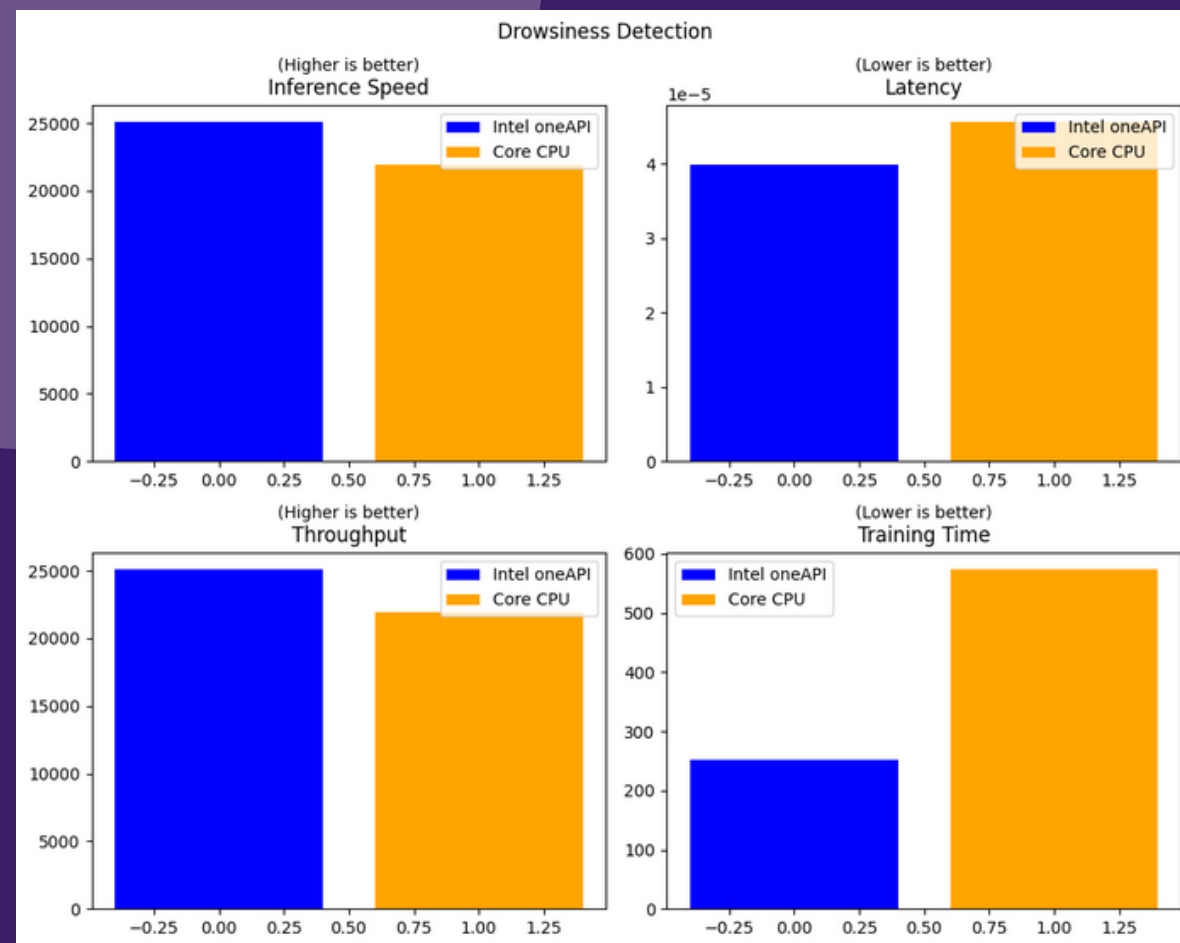
The `test_train_split` function from scikit-learn (sklearnex) is particularly helpful in our models. It enables us to split our dataset into training and testing subsets, facilitating proper model evaluation and validation. This function ensures that our models are trained on a representative subset of data and are subsequently tested on an independent portion, helping us gauge their performance accurately. In addition, the `patch` functionality of scikit-learn (sklearnex) allows us to apply specific fixes or modifications to the library, enhancing its compatibility with our models and ensuring seamless integration.

These combined capabilities of scikit-learn (sklearnex) and the `test_train_split` function enable us to effectively train and evaluate our models, leading to more accurate predictions and reliable performance.

Faster inference speed is crucial in deployment, as it ensures real-time responsiveness and enables scalability in high-concurrency scenarios. It also contributes to cost efficiency by optimizing resource utilization. The Intel i5 11th gen processor plays a pivotal role in driving the efficiency and speed of our models in our web-based education platform.



Drowsiness Detection System



OpenMP Params used

inter: 6
intra: 6
KMP_BLOCKTIME: 1
Test_Set: 25

Benchmarks Rates

Inference Time Rate: 1.14
Latency Rate: 0.87
Throughput Rate: 1.14
Training Time Rate: 0.43

OpenMP Params used

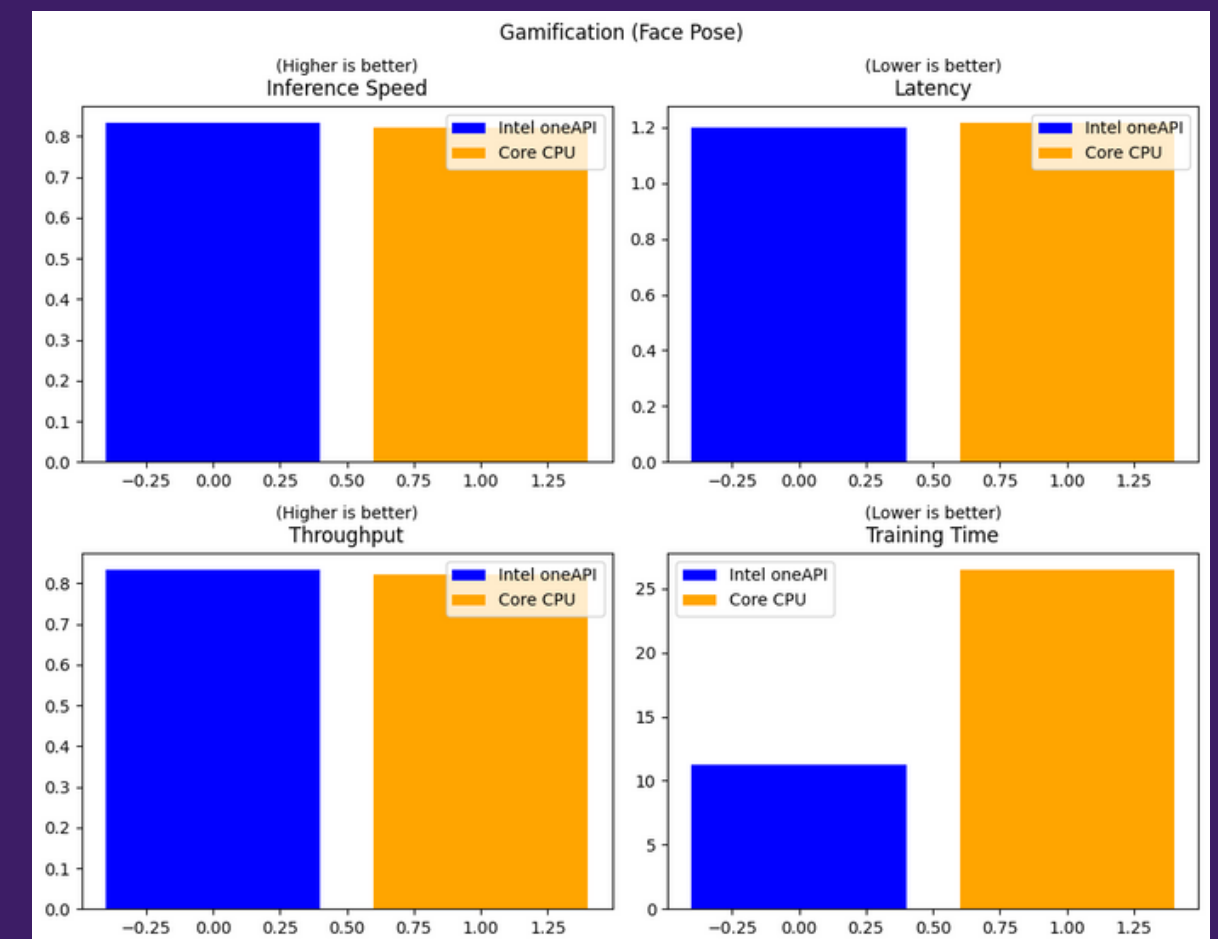
inter: 2
intra: 6
KMP_BLOCKTIME: 0
Test_Set: 25

Benchmarks Rates

Inference Time Rate: 1.013
Latency Rate: 0.98
Throughput Rate: 1.01
Training Time Rate: 0.42

Result Summary

Gamify Quiz



Important Links



Mental Health Chatbot

Video Links

Full Project Description

<https://youtu.be/N8nnZsvOhVo>

Optimization by Intel oneAPI Description & Benchmark

<https://youtu.be/2GJiBfsu9LE>

GitHub Repository Link

https://github.com/SaumyaSrivastava13/Phoenix_13

Medium Blog Link

<https://medium.com/@kulshrestha.sujal13/open-innovation-in-education-dcd67bebdad7>

OpenMP Params used

inter: 2

intra: 6

KMP_BLOCKTIME: 1

Test_Set: 20

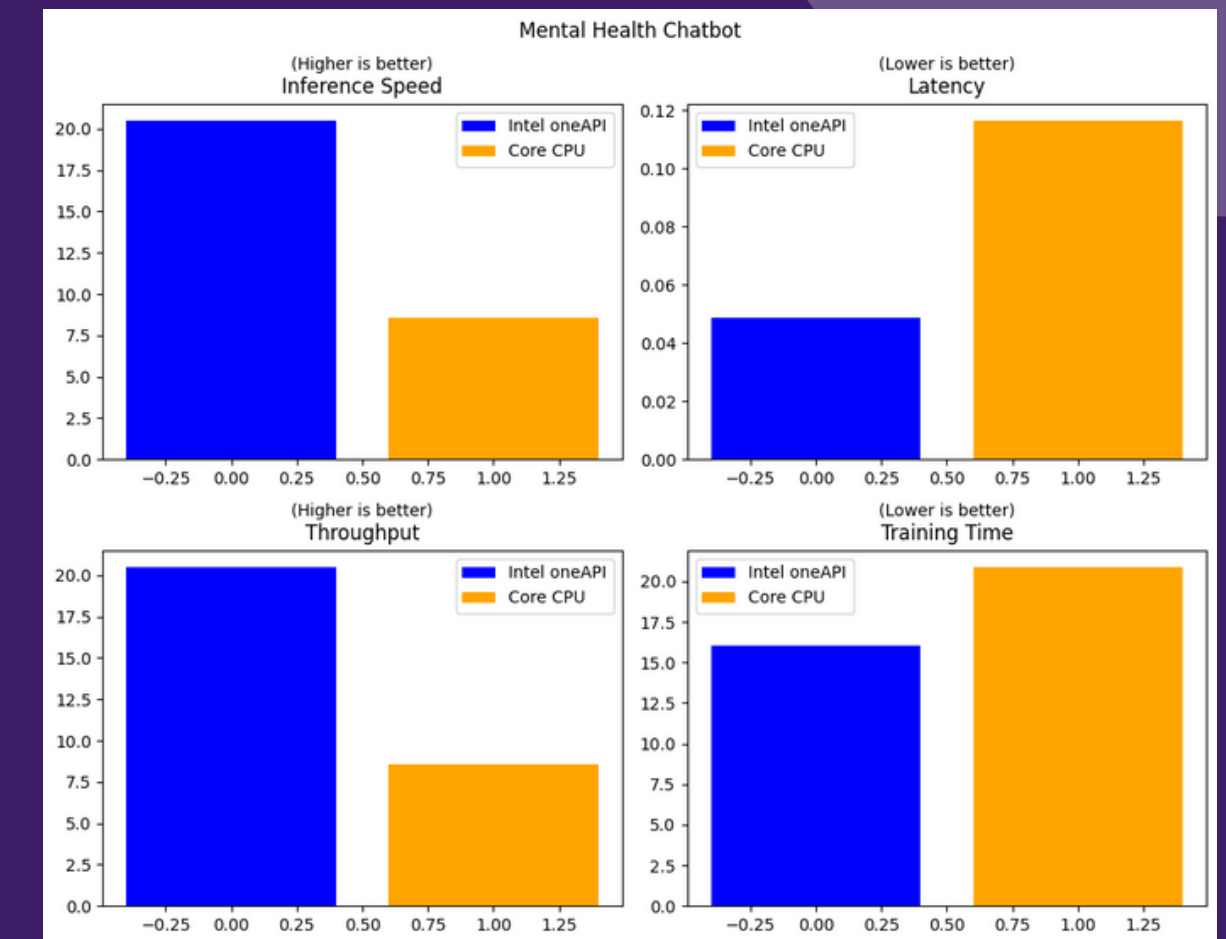
Benchmarks Rates

Inference Time Rate: 2.38

Latency Rate: 0.41

Throughput Rate: 2.38

Training Time Rate: 0.77



The Intel i5 11th gen 11260H processor, with its 6 cores and 12 threads, is a powerful computing platform that significantly contributes to the performance of our models. Leveraging the capabilities of Intel oneDNN and OpenMP optimizations, we maximize the potential of this processor by harnessing parallelism and efficient deep learning primitives provided by the Intel API. This integration enables our models to leverage multi-threading capabilities and take full advantage of the processor's computational power, resulting in accelerated training, improved throughput, enhanced inference speed, and reduced latency.

The Intel API empowers our models to efficiently utilize the resources of the Intel i5 11th gen processor, delivering optimal performance and efficiency in our educational platform.

Note: You can read the brief description of the entire project on both GitHub Repo & Medium Blog.



More than anything, we wish to fuel the spirit of
inquisitiveness in young minds and let their will rise, to
drive them beyond the shores of victory.

THANK YOU