LEAP powered by Intel® oneAPI AI Analytics Toolkit

Problem Statement : **Open Innovation in Education**

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Problem Statement

MOOCs (Massive Open Online Courses)	200K Users in 2012	380M Users in 2020	34.26% CAGR 2022-27*	5% -10% Completion rate

Key Challenges

- Lengthy videos
- Instructor Availability
- Slow response from forums
- No real time Q&A/Mentor

Approach

LEAP

(Learning Enhancement and Assistance Platform)

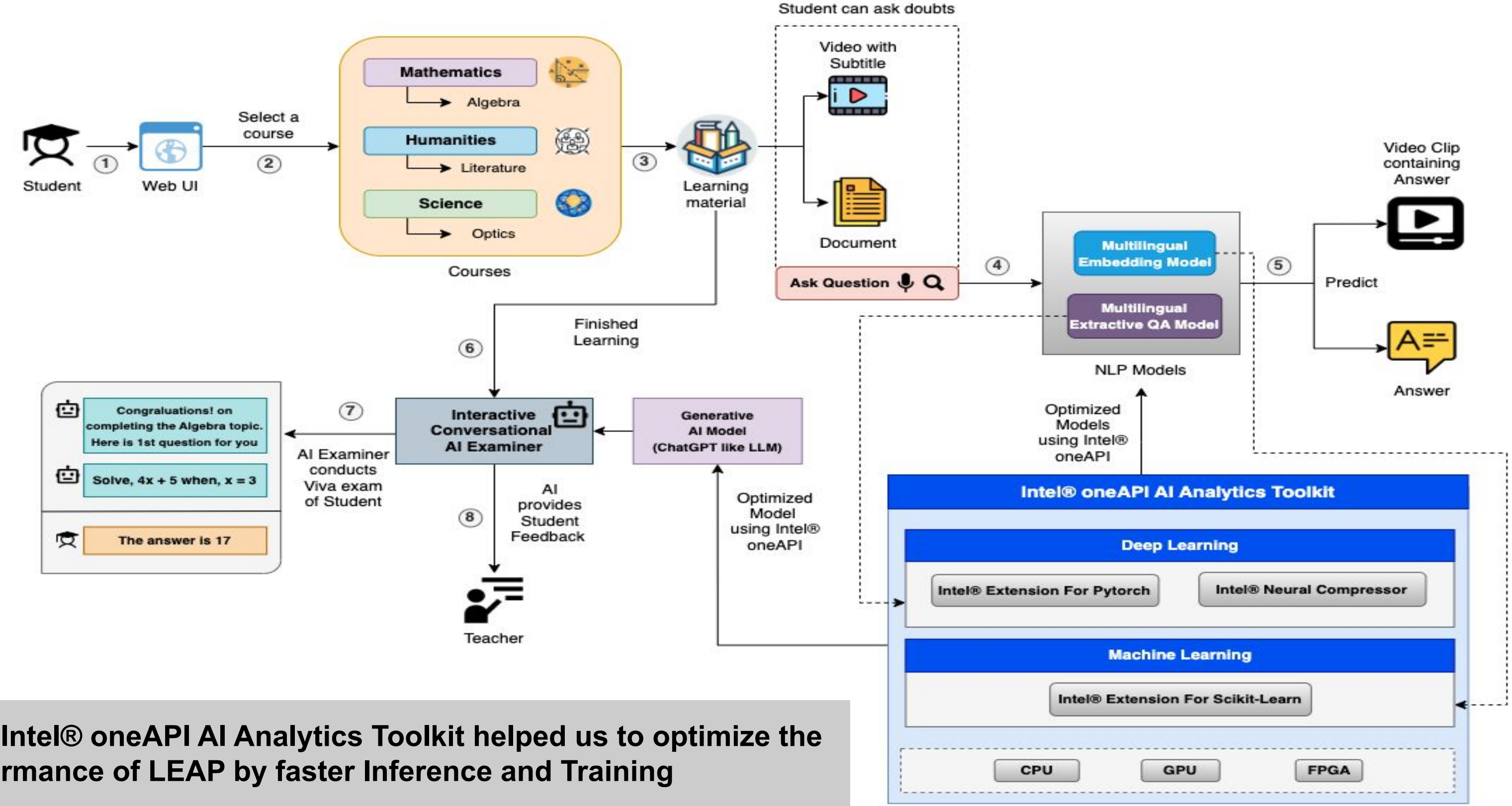
- AI based platform
- Powered by Intel OneAPI
- Quality Education
- All time Availability

Key Features of LEAP

- **Ask Question/Doubt**
- **Conversational AI Examiner**
- **Feedback from AI Examiner**
- **Multilingual Support**

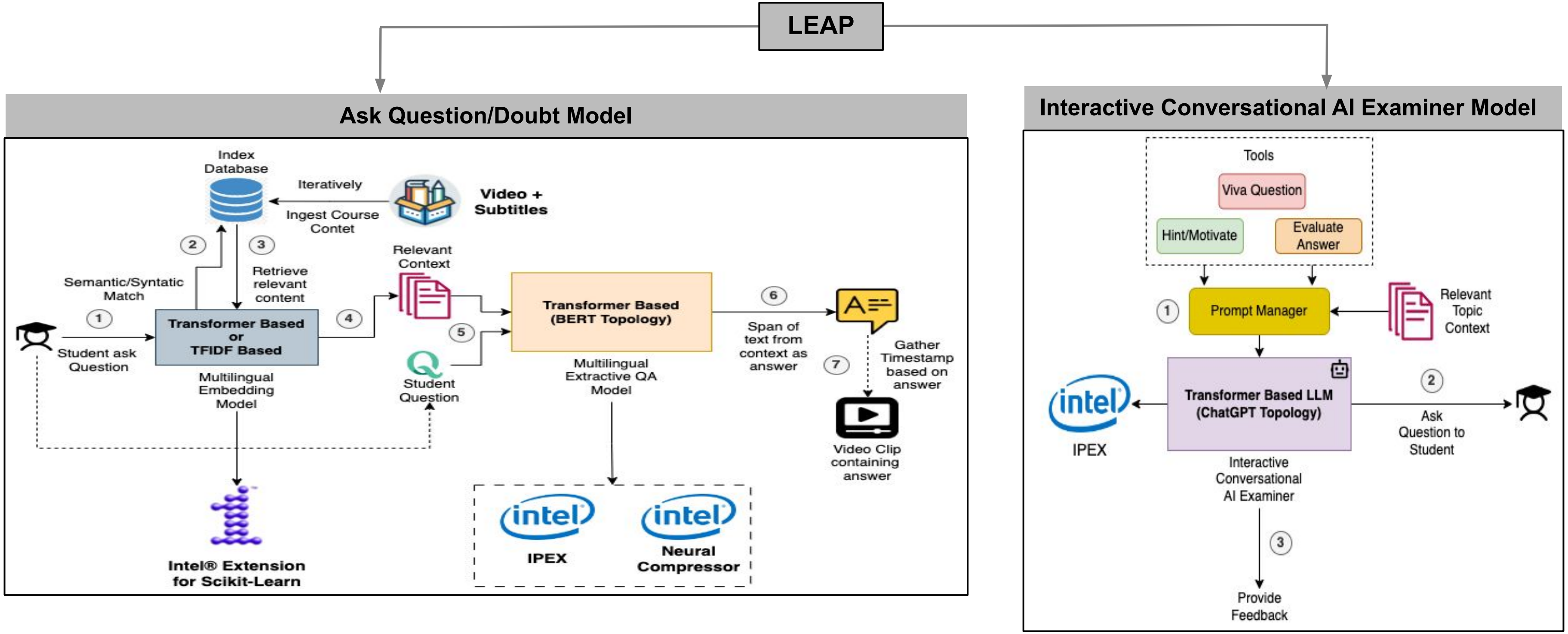
Reference: PRNewswire , Edtechreview; holoniq

High Level Architecture


Student can ask doubts
Student
1
Web UI
Select a course
2
Mathematics
Algebra
Humanities
Literature
Science
Optics
Courses
3
Learning material
Video with Subtitle
Document
Ask Question
4
Multilingual Embedding Model
Multilingual Extractive QA Model
NLP Models
5
Predict
Video Clip containing Answer
Answer
Finished Learning
6
Congraluations! on completing the Algebra topic. Here is 1st question for you
Solve, 4x + 5 when, x = 3
The answer is 17
7
AI Examiner conducts Viva exam of Student
Interactive Conversational AI Examiner
Generative AI Model (ChatGPT like LLM)
8
AI provides Student Feedback
Teacher
Optimized Model using Intel® oneAPI
Optimized Models using Intel® oneAPI
Intel® oneAPI AI Analytics Toolkit
Deep Learning
Intel® Extension For Pytorch
Intel® Neural Compressor
Machine Learning
Intel® Extension For Scikit-Learn
CPU
GPU
FPGA

Here Intel® oneAPI AI Analytics Toolkit helped us to optimize the performance of LEAP by faster Inference and Training

LEAP: Detailed Model Architecture Diagram for Both Components



LEAP

Ask Question/Doubt Model

Index Database

Iteratively

Ingest Course Contet

Video + Subtitles

2

3

Semantic/Syntatic Match

Retrieve relevant content

Relevant Context

1

Student ask Question

Transformer Based or TFIDF Based

4

5

Transformer Based (BERT Topology)

6

Span of text from context as answer

7

Gather Timestamp based on answer

Multilingual Embedding Model

Student Question

Multilingual Extractive QA Model

Video Clip containing answer

Intel® Extension for Scikit-Learn

intel

IPEX

intel

Neural Compressor

Interactive Conversational AI Examiner Model

Tools

Viva Question

Hint/Motivate

Evaluate Answer

1

Prompt Manager

Relevant Topic Context

intel

IPEX

Transformer Based LLM (ChatGPT Topology)

2

Ask Question to Student

Interactive Conversational AI Examiner

3

Provide Feedback

Static-QAT-INT8 is 4.44x times faster in performance as compared to baseline For our Extractive QA Model

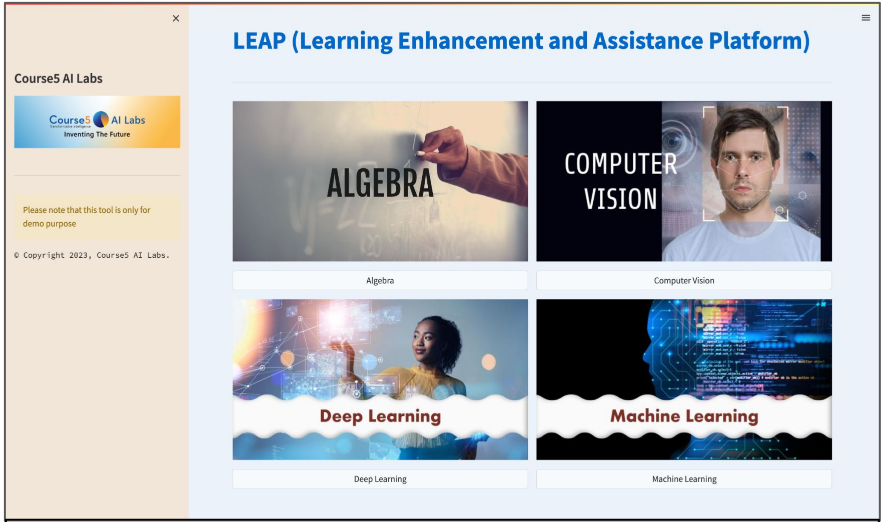
Ask Question/Doubt Model				
Extractive Question Answering Model				
	Pytorch (Base) - FP32	Pytorch (IPEX) - FP32	**Static-QAT-INT8**	Static-Smooth-QAT-INT8
Latency (milli sec)	64.513	39.329	**14.514**	15.24
Throughput (samples/sec)	15.501	25.427	**68.9**	65.616
F1 Score (SQuAD-v1)	**76.11**	**76.11**	75.72	75.72

Interactive Conversational AI Examiner Model		
TFIDF Embedding Model		
	Scikit-Learn (Base)	**Intel Extension For Scikit-Learn**
Latency (milli sec)	0.761	**0.752**
Throughput (samples/sec)	1313.63	**1330.49**

*Table: Latency/Throughput/Speed-Up Benchmark result for **our Extractive Question Answering ALBERT Model (Multilingual) and TFIDF Embedding Model** on Intel® Dev Cloud machine (**Intel® Xeon® Platinum 8480+ (4th Gen: Sapphire Rapids) - 224v CPUs 503GB RAM**) with optimization using IPEX-FP32, Static-QAT-INT8 using Intel® Neural Compressor and TFIDFVectorizer using Intel® Extension for Scikit-Learn.*

Demo Link and Screenshots

Link: https://www.youtube.com/watch?v=M51BFcoJa3k



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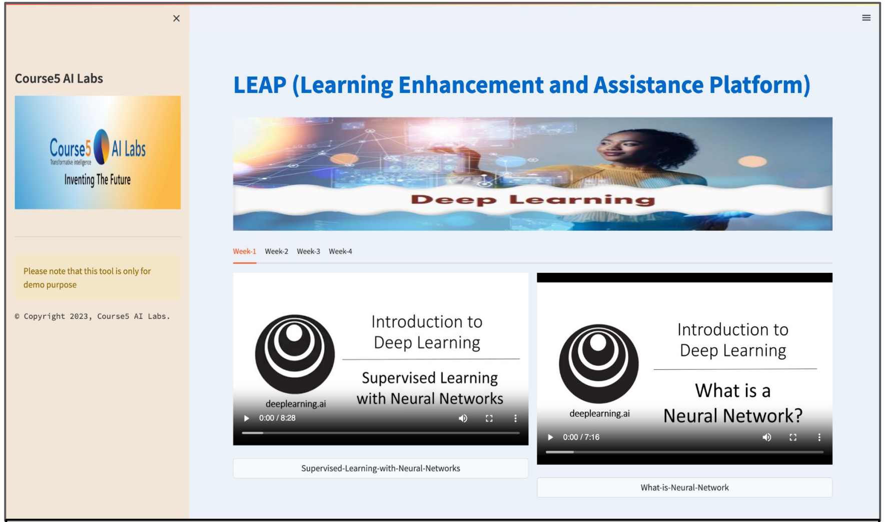
LEAP (Learning Enhancement and Assistance Platform)

Screen-1 (Dashboard Page)



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LEAP (Learning Enhancement and Assistance Platform)

×
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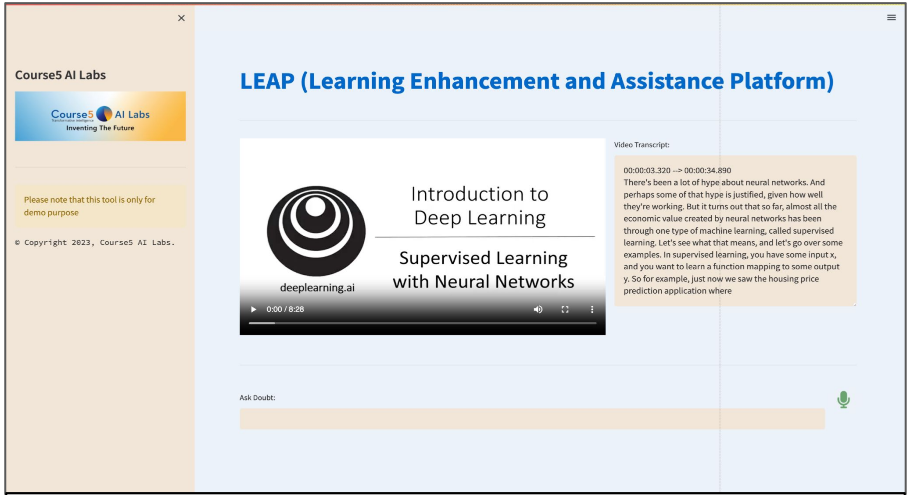
Inventing The Future
Deep Learning
Week-1
Week-2
Week-3
Week-4
deeplearning.ai
Introduction to Deep Learning
Supervised Learning with Neural Networks
0:00 / 8:28
Supervised-Learning-with-Neural-Networks
deeplearning.ai
Introduction to Deep Learning
What is a Neural Network?
0:00 / 7:16
What-is-Neural-Network

Screen-2 (Week wise Content Page)

Demo Screenshots



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LEAP (Learning Enhancement and Assistance Platform)

Introduction to Deep Learning

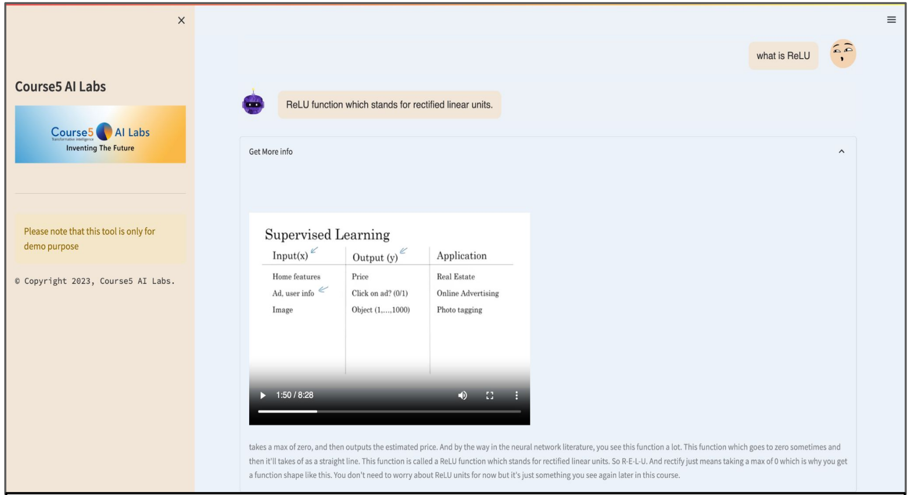
Supervised Learning with Neural Networks

Video Transcript:

00:00:03.320 --> 00:00:34.890
There's been a lot of hype about neural networks. And perhaps some of that hype is justified, given how well they're working. But it turns out that so far, almost all the economic value created by neural networks has been through one type of machine learning, called supervised learning. Let's see what that means, and let's go over some examples. In supervised learning, you have some input x, and you want to learn a function mapping to some output y. So for example, just now we saw the housing price prediction application where

Ask Doubt:

Screen-3 (Ask Question/Doubt Page)



what is ReLU

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ReLU function which stands for rectified linear units.

Get More info

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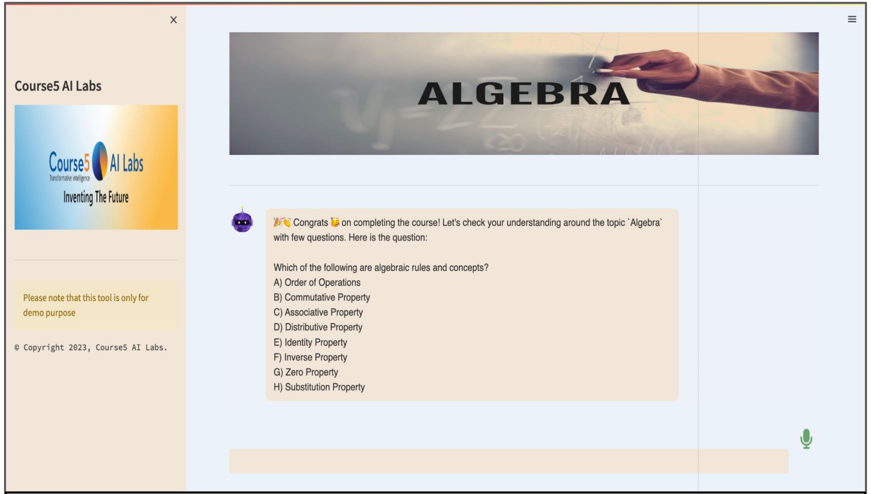
Supervised Learning

Input(x)	Output (y)	Application
Home features	Price	Real Estate
Ad, user info	Click on ad? (0/1)	Online Advertising
Image	Object (1,....,1000)	Photo tagging

takes a max of zero, and then outputs the estimated price. And by the way in the neural network literature, you see this function a lot. This function which goes to zero sometimes and then it'll takes of as a straight line. This function is called a ReLU function which stands for rectified linear units. So R-E-L-U. And rectify just means taking a max of 0 which is why you get a function shape like this. You don't need to worry about ReLU units for now but it's just something you see again later in this course.

Screen-4 (Ask Question/Doubt Page)

Demo Screenshots



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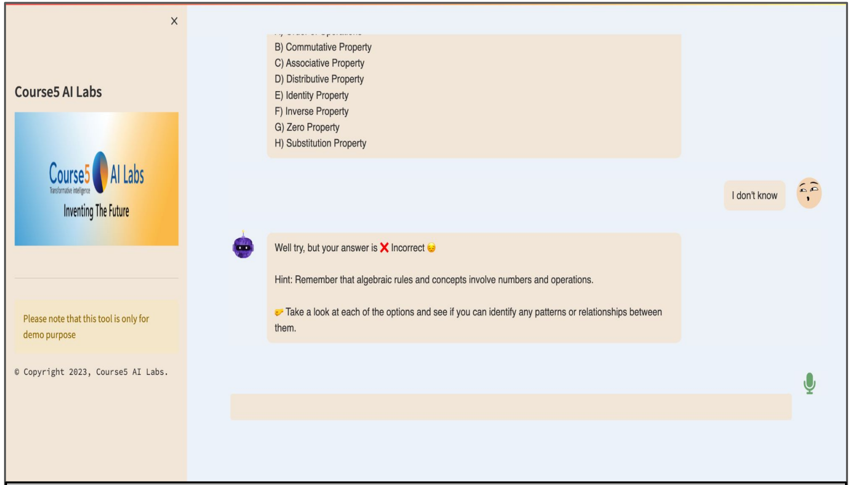
🎉👏 Congrats 🥳 on completing the course! Let's check your understanding around the topic `Algebra` with few questions. Here is the question:

Which of the following are algebraic rules and concepts?
A) Order of Operations
B) Commutative Property
C) Associative Property
D) Distributive Property
E) Identity Property
F) Inverse Property
G) Zero Property
H) Substitution Property

Screen-5 (Interactive Conversational AI Examiner Asks Question to student)



Please note that this tool is only for demo purpose

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B) Commutative Property
C) Associative Property
D) Distributive Property
E) Identity Property
F) Inverse Property
G) Zero Property
H) Substitution Property

I don't know

Well try, but your answer is ❌ Incorrect 😔

Hint: Remember that algebraic rules and concepts involve numbers and operations.

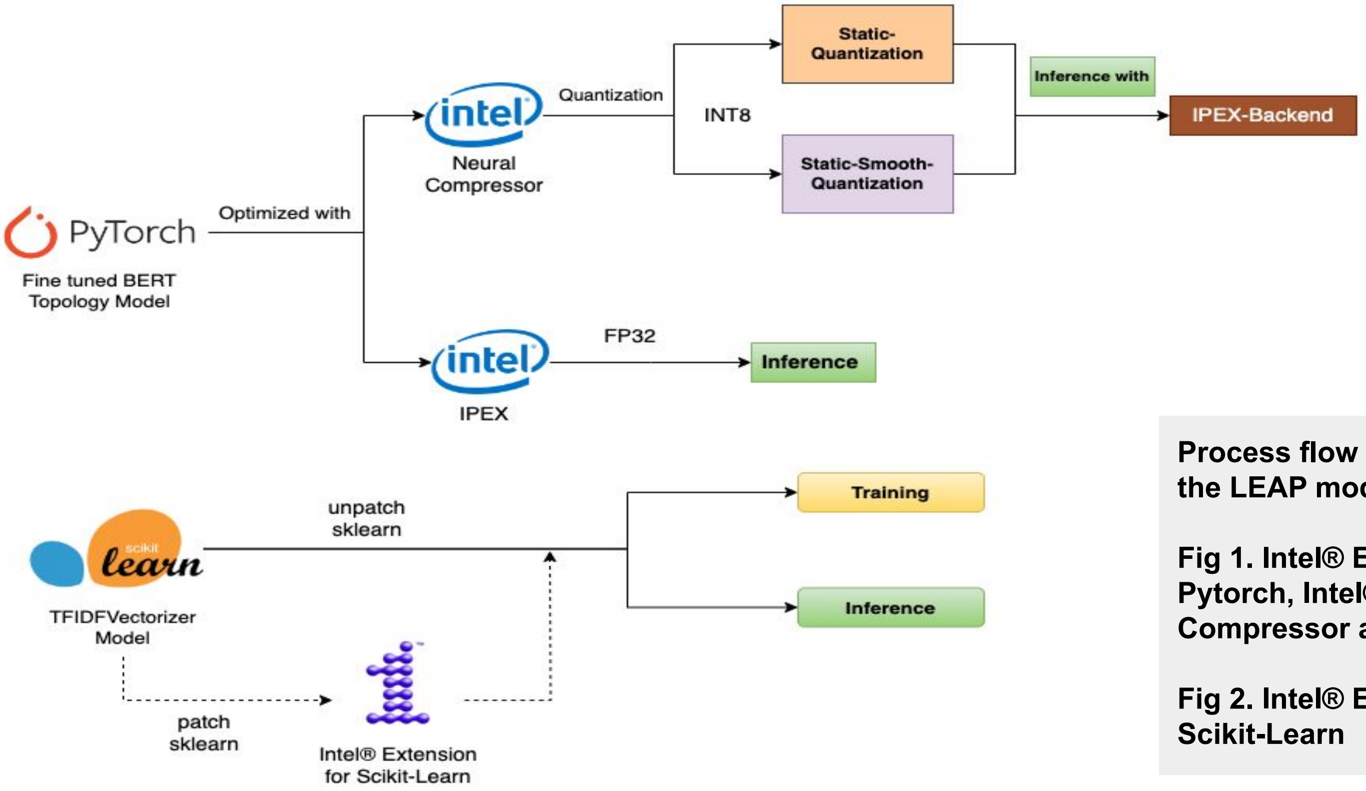
🫱 Take a look at each of the options and see if you can identify any patterns or relationships between them.

Screen-6 (Interactive Conversational AI Examiner provides hints and motivates a student in case of a wrong answer)

GitHub Link (Codes should be public and available after hackathon also)

https://github.com/rohitc5/intel-oneAPI

Result Summary (unique aspects of oneAPI/SYCL used)

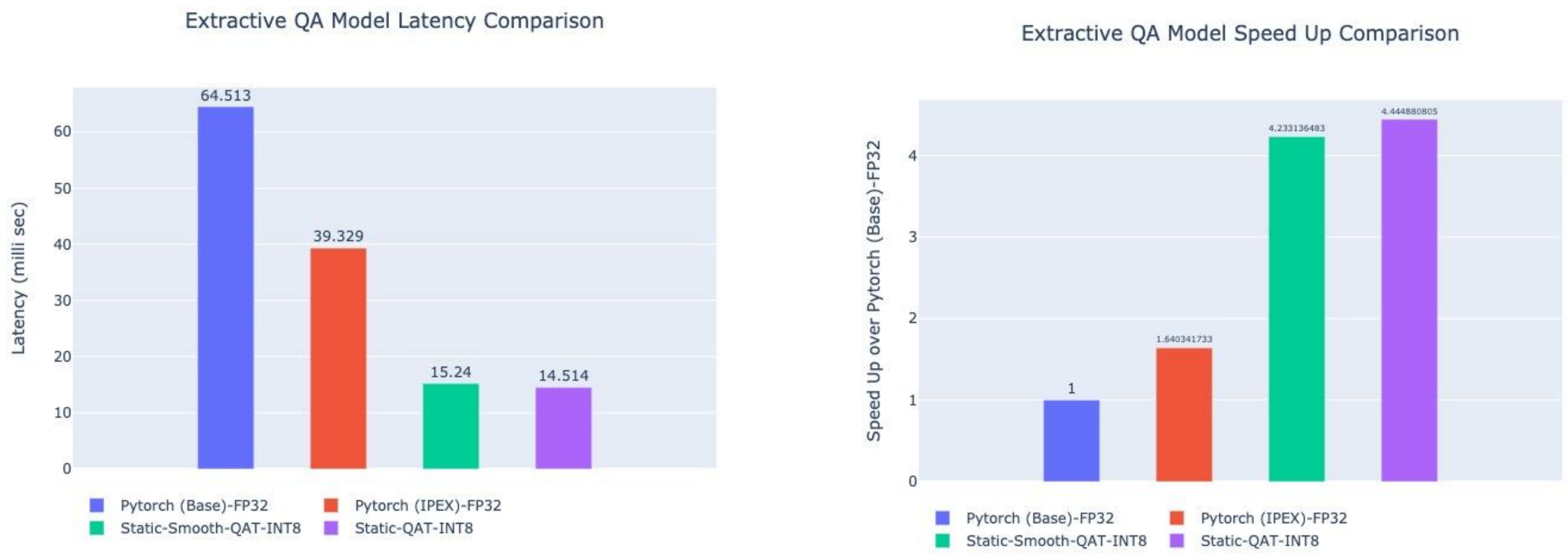


Process flow to optimize the LEAP models by using

Fig 1. Intel® Extension for Pytorch, Intel® Neural Compressor and

Fig 2. Intel® Extension for Scikit-Learn

Extractive QA Model (BERT Topology) Latency/Speed-Up Comparison with IPEX and Intel® Neural Compressor


Extractive QA Model Latency Comparison

Extractive QA Model Speed Up Comparison

Fig: Latency/Speed-Up Benchmark result for ***our Extractive Question Answering ALBERT Model (Multilingual)*** *on Intel® Dev Cloud machine (****Intel® Xeon® Platinum 8480+ (4th Gen: Sapphire Rapids) - 224v CPUs 503GB RAM****) with optimization using IPEX-FP32 and Static INT8-Quantization using Intel® Neural Compressor.*

For Ask Question/Doubt Extractive QA Model

Extractive QA Model (BERT Topology) Throughput/F1 Score Comparison with IPEX and Intel® Neural Compressor

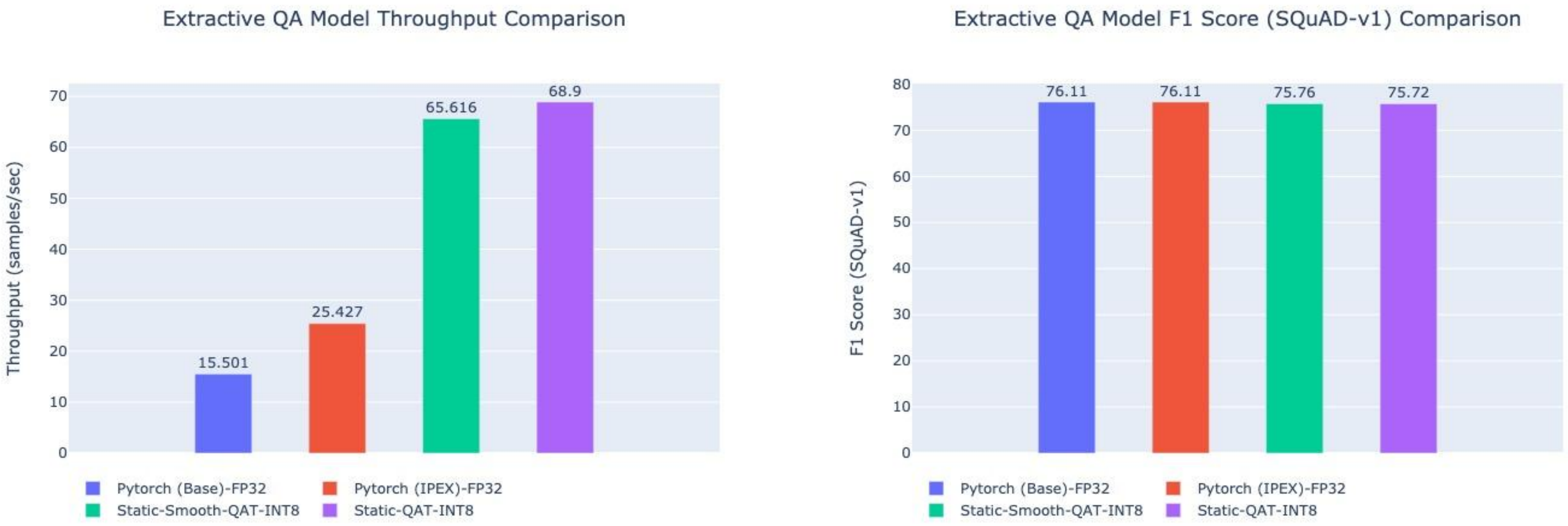


*Fig: Throughput/F1 Score Benchmark result for **our Extractive Question Answering ALBERT Model (Multilingual)** on Intel® Dev Cloud machine (**Intel® Xeon® Platinum 8480+ (4th Gen: Sapphire Rapids**) **- 224v CPUs 503GB RAM**) with optimization using IPEX-FP32 and Static INT8-Quantization using Intel® Neural Compressor. Also, the model (https://huggingface.co/ai4bharat/indic-bert) was fine-tuned on SQuAD-v1 dataset.*

For Ask Question/Doubt Extractive QA Model

Scikit-Learn (Base) vs Intel® Extension for Scikit-Learn

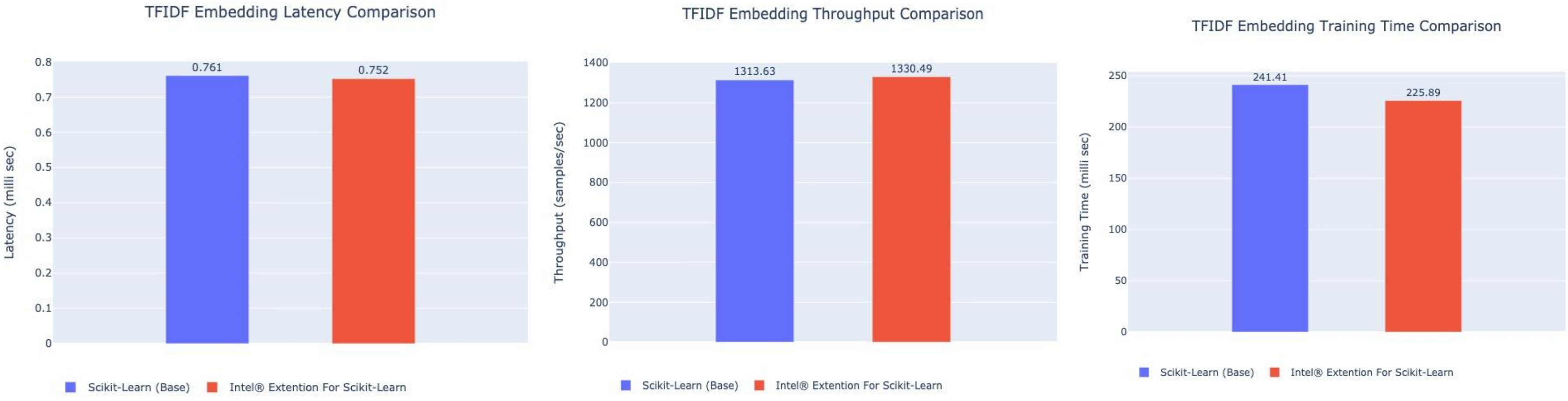


Fig: Benchmark results for ***TFIDFVectorizer*** *Embedding model during training and inference on Intel® Dev Cloud machine (****Intel® Xeon® Platinum 8480+ (4th Gen: Sapphire Rapids) - 224v CPUs 503GB RAM****). Please Note that we don't see much of a difference may be because we used a tiny dataset.*

For Ask Question/Doubt Embedding Model

Model Checkpoint Release

https://huggingface.co/rohitsroch

1
oneAPI
<HACK>ATHON

THANK YOU