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| KARTHIK THALLAM | 500188370 | **As Posted on Moodle** | **25%** |

***Problem Statement*: Do a Case study on the different tools, frameworks, libraries, models and datasets used by Facebook in AI. Analyse them and make a report mentioning it’s Main Purpose, Overview, how to use followed by some Use cases**

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| Frameworks/Tool  Name | Link / Website | Main  Purpose/Use | Main Overview  (Bullet Points) | Student Brief Recommendation of How to use it (Bullet Points) |
| 1) PyTorch | 1)<https://ai.facebook.com/tools/#frameworks-and-tools>  2) <https://pytorch.org/> | PyTorch is mainly used to implement deep learning algorithms like Artificial Neural Networks, Convolutional Neural Networks, Recurrent Neural Networks, etc.. | * It is an Open-source flexible deep learning framework * Provides complete end to end workflow support for production deployment and distributed training * It has a powerful ecosystem of tools and libraries which helps in developing NLP and Deep Learning Applications | * For the best experience, we have to install PyTorch with a package manager called Anaconda which provides all the underlying dependencies of the PyTorch * It is highly recommended to install CUDA if your machine has CUDA enabled GPU to use the complete power of PyTorch’s CUDA support * Provides python packages like NumPy used for N dimensional array computations with powerful GPU accelerations. * PyTorch is used in classifying the images like CIFAR-10 data using Convolutional Neural Networks * PyTorch is used in Sequence Forecasting like Sales Forecasting or Time Series Forecasting using Recurrent Neural Networks * You can use major cloud platforms for developing deep learning models using PyTorch |
| 2) ONNX (Open Neural Network Exchange) | 1)<https://ai.facebook.com/tools/onnx>  2)<https://www.upgrad.com/blog/top-deep-learning-frameworks/> | ONNX is a deep learning framework which provides an open environment where we can build our AI models in one framework and transfer it to another framework for inference | * ONNX was designed to provide an ecosystem for easy switching of AI models between different frameworks * Because of it’s Framework Interoperability, we can train our models in one of the ONNX supported frameworks and then transfer or deploy them into other frameworks | * From the official ONNX site, go to the GitHub page of ONNX Model Zoo which is a collection of several pre-trained models that are used to make predictions on the new data by running the inference with the trained models * Download the required pre-trained models that suits your requirement. For example, if you want to classify the images then download the pre-trained image classification model from ONNX Model Zoo and then test it on the new data * ONNX compatible runtimes and libraries helps to maximize the performance across the hardware systems and hence it is easy to access hardware optimization with ONNX * You can use ONNX for computer vision algorithms and Natural Language Processing models for tracking the objects and Sentiment analysis respectively |
| 3) Glow | 1)<https://ai.facebook.com/tools/glow>  2)<https://medium.com/pytorch/glow-compiler-optimizes-neural-networks-for-low-power-nxp-mcus-e095abe14942> | Glow is a machine learning compiler used to accelerate the inference performance of NN frameworks on different hardware systems | * Glow acts like a back end for complex machine learning frameworks there by providing optimizations and generating code for NN graphs * It takes in a computation graph and generates a powerful optimized code over two phases * In First phase, it optimizes the layers of the model using kernel fusion * In Second phase, it uses certain modules to enable target-specific optimizations | * Glow runs on MacOS and Linux and required to have a latest C++ compiler, LLVM and protocol buffers and then follow the installation instructions given on the official GitHub page * You should compile models into bundles that are used to execute the model in a standalone mode there by reducing the cost of compile time * You can use ResNet50 example model to know the compilation time it took with and without Glow bundles * You can use Glow in optimization of Image Classification models |
| 4) Visdom | 1)<https://ai.facebook.com/tools/visdom> | Visdom, a tool used for interactive visualizations on the live data so that you can find insights from the data which runs on remote servers | * Visdom is used to visualize Categorical, Distribution, and Grid plots interactively * Visdom has call-backs feature that allows to interact and react with the front-end events | * You need to have Python 3 stable source in order to use Visdom * Visdom is used to multi dimensional plots just like Plotly and Cufflinks * Some of the basic visualization functions that can be used with Visdom are: vis.image, vis.audio, vis.matplot * You can use and plot to separate the different categories of the data against the numerical data just like hue * Visdom plotted canvas can be viewed in the browsers and can be shared easily with the other users * You can use server API for having Plotly convention of visualizing the data as some of the visualizations like 2D scatter plot and 3D scatter plots are powered by Plotly |
| 5) DynaBench | 1)<https://ai.facebook.com/tools/dynabench/> | DynaBench, a benchmarking tool used to test the models and evaluate the models by collecting the data dynamically | * It uses ensemble approach while collecting the data and sending it to another model * This approach is 10 times better than training and evaluating the static data which will be outdated for the new technology | * Go to the official website of DynaBench * You will be having different types of tasks to work on and choose your task according to your requirement like NL Inference, Sentiment Analysis etc. * It firsts collects the data evaluate the model on that data then gets the predictions * Then the above predictions and observed inferences will be feed into another model and repeats the same * Because of this ensembled approach the approximations of the final model will be unbiased and more accurate * You can pass your own data to validate or else you can use other people’s examples for validation and see the results * This benchmark tool can be used in any of the text analytics use cases like Review Analysis and Rating classification |
| 6) COVID-19 Forecasting | 1)<https://ai.facebook.com/tools/covid-19-forecasting/>  2)<https://dataforgood.fb.com/tools/covid-19-forecasts/> | Facebook AI’s COVID-19 Forecasts acts like a tool which is used to help researchers, Health Experts and Organizations to get the insights about the spread of virus in the best way possible | * These Forecasts are made by collecting the data at a county-level there by making in depth analysis of pandemic * They used Adaptive models which adapts to the new trends without any hassle there by making an agile data analysis | * The Forecasting data is open sourced and can be downloaded from Facebook Data for good through Humanitarian Data Exchange * This data is currently used by New York University, Cornell University and many other universities in US to use it in their models to know progression of the disease thereby taking necessary requirements to control the spread of the disease |
| 7) DensePose | 1)<https://analyticsindiamag.com/understanding-densepose-facebooks-new-tool-that-revolutionises-human-body-estimation/>  2)<https://ai.facebook.com/tools/densepose> | DensePose, a computer vision tool used to estimate the human pose by looking at all the human pixels of a 2D three colored channel RBG image into a 3D surface-based Image Interpretation | * It is trained on a data set called DensePose COCO * This dataser contains 50,000 COCO images * This dataset was used to train DensePose-RCNN that uses to draw the inferences from complex backgrounds and different scale variations | * DensePose-RCNN is designed in detectron framework * You need to have NVIDIA GPU, Python2, Caffe2, python packages and the COCO API * It can be used researchers and engineers working on scanners and 3D printing applications * This tool can be used in many of the human body tracking use cases like detecting danger signs in the public, movement of body in the sports analytics etc. |
| 8) PyText | 1)<https://ai.facebook.com/tools/pytext>  2)<https://analyticsindiamag.com/heres-what-you-need-to-know-about-pytext-facebooks-new-open-source-project/> | PyText is a deep learning NLP based framework used for the very fast implementation of NLP models and deploying them for a large scale serving | * It helps researchers to train NLP models on their own data and export them to Caffe2 through ONNX * Some of those distributed training processed NLP tasks are: Document Classification, Semantic parsing and Multi-task learning * PyText is designed in such a way that they can easily support new tasks and new models allowing the reuse of prebuilt components from other tasks or models | * Install PyText using `pip install pytext-nlp` * You can write a model in this framework, train and evaluate them in a benchmark tool and deploy them in AWS * This is used to develop NLP models for conversational AI, Voice commands like Portal, and Deep Text * This is also used in various NLP applications like Article Classification, Parallel Text learning etc. |

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| Libraries, Models & Datasets | Link / Website | Main  Purpose | Overview | Student Brief Recommendation of How to use it |
| 9) Tensor Comprehensions | 1)<https://facebookresearch.github.io/TensorComprehensions/introduction.html>  2)<https://github.com/MattPainter01/Grouped3DConvPyTorch>  3)<https://ai.facebook.com/tools/tensorcomprehensions> | TC is a library used to obtain faster development process by automatically synthesizing high performance machine learning kernels | * TC is a C++ library and a mathematical language which helps researchers and engineers to develop powerful large-scale models * TC boosts productivity by simplifying ML framework implementations by using a powerful syntax which can be translated to high-performance computation kernels automatically | * You need to have a package manager called Anaconda in order to get all the underlying dependencies and then install Tensor Comprehensions as mentioned in the official GitHub page of Tensor Comprehensions * TC is used to for finding a way to tune faster multi-dimensional convolutional modules * TCs can be used for implementing faster multi dimensional Convolutional models by integrating with PyTorch framework * TC is often used with PyTorch as it provides lightweight integration with PyTorch and many other frameworks and also used in both Python and C++ |
| 10) FAISS (Facebook AI Similarity Search) | 1) <https://medium.com/ai-in-plain-english/speeding-up-similarity-search-in-recommender-systems-using-faiss-basics-part-i-ec1b5e92c92d>  2)<https://ai.facebook.com/tools/faiss> | FAISS is a library written in C++ language used for searching the similarity and bindings of the similar multimedia documents | * FAISS uses a technique called Approximate Nearest Neighbours search which helps in the faster similarity search * It can be used with python-based libraries as it has python bindings and some of the complex algorithms are implemented on GPU | * Install FAISS through Anaconda * FAISS compilation first compiles the C++ examples and then compiles Python interface * FAISS can be used in Recommendation systems, Principal Component Analysis and Dimensionality Reduction Algorithms * You can compare the performance of FAISS against the regular Scikit-learn library using the above algorithms and you can see the speed of FAISS is very high |
| 11) StarSpace | 1)<https://ai.facebook.com/tools/starspace>  2)<https://towardsdatascience.com/starspace-mining-and-embedding-user-interests-28081937f95> | StarSpace is used to find and learn the connections between the entities or users and their sub entities like articles efficiently in order to solve different problems in text analytics | * StarSpace tries to represent the entities of different types in the same vector plane to compare efficiently * This helps to solve various problems in Recommendation Systems, Text Analytics, Sentiment Analysis and Image Classification | * Using StarSpace has many advantages but the only requirement is you have to provide the linkages between entities and their sub entities * It uses C++ features and hence it is required to have a compiler which supports C++ * Install Boost library and specify its path to run StarSpace * StarSpace is used to Review Classification, Ranking the highest connected document in a case study, Image Text Classification and Cosine Similarity Recommendation Systems |
| 12) Detectron2 | 1)<https://ai.facebook.com/tools/detectron2>  2)<https://analyticsindiamag.com/detectron2/> | Detectron2 is FAIR’s library used for object detection and many other computer vision algorithms for a rapid development process | * It is built using PyTorch and originates from Mask R-CNN benchmark * You can easily export the models to some other formats for inferences or deployment * Some of the new important features are Dense pose, Panoptic Segmentation and DeepLab * The training period is very rapid and takes very less time for implementation | * You need to have a python 3.6+ versions, PyTorch 1.5+ versions and OpenCV * Install dependencies as mentioned on the official GitHub page of Detectron2 * Install Detectron2 and set up a Detectron2 logger * This Detectron2 library is used for the faster object detection use cases like Traffic Sign Boards, Road Lanes and Face mask detection |
| 13) FastText | 1)<https://ai.facebook.com/tools/fasttext>  2)<https://towardsdatascience.com/fasttext-under-the-hood-11efc57b2b3> | FastText is a library used in NLP application development for learning the word representations and Text Sentence Classification efficiently | * It allows to train both supervised and unsupervised representation of words and sentences * It can classify Text in the most efficient way as it is very quick in iterating the model and refining the model and can be trained on more than 100 million words on any multi core CPU in a very less time | * You need to have a C++ modern compiler along with Python, NumPy and SciPy installed on your machines * This library has pre-trained models that stored the inferences using 157 different languages on Wikipedia * This can be used in Text Classification applications, Word representation learning, obtaining word vectors from vocabulary words there by using it for Similarity findings in Text Analytics |
| 14) MUSE (Multi-lingual Unsupervised and Supervised Embeddings) | <https://ai.facebook.com/tools/muse> | MUSE is a library used for faster evaluation and easier development of multi-lingual word embeddings and NLP applications | * It provides the multi-lingual word embeddings in a common space * It also provides large scale efficient bilingual explanations and dictionaries for training and validation | * You need to have Python 2 or Python 3, NumPy, PyTorch installed on your machines * Clone MUSE and download mono and multi-lingual word embeddings validation datasets * MUSE is mainly used in some of the NLP applications where language translations (both voice and text data) are required * The supervised method uses bilingual dictionary or identical data type strings or characters whereas unsupervised does not use any of the parallel data |
| 15) CoVoST | <https://ai.facebook.com/tools/covost/> | CoVoST (Common Voice Speech to Text Translation), is a large-scale database that has multi-lingual speech to text translations and hence used for multi-lingual translation NLP applications | * It can translate English language into 15 languages and 21 languages into English with over 78,000 speakers and 2,880 hours of speech | * The standard Speech to Text translation had a lower inference latency, less errors but there is lack of parallel data * There were two releases in this research: CoVoST1, CoVoST2 while the earlier release is capable of translating 11 languages into English, the latter is capable of translating 21 languages into English * If you want to use CoVoST1, then download Common Voice audio clips and transcripts version 3 available form their official GitHub page * If you want to use CoVoST2, then download Common Voice audio clips and transcripts version 4 available from their official GitHub page * This data can be used in many voice assistant applications like customer service, google maps directions, and can be used in various other Natural Language Processing applications involving multi-lingual conversations |
| 16) Hateful Memes Challenge and Dataset | 1)<https://ai.facebook.com/tools/hatefulmemes/>  2)<https://www.drivendata.org/competitions/64/hateful-memes/> | The Hateful Memes Challenge and Dataset is a competition which is made available to public and can be used as a metric to calculate or check the progress in multi modal language and vision classification | * The biggest challenge for AI is to think the way human does and understanding the context in all the various situations * One of those challenges is to understand the memes which has both pictures and text * As a human we know they are related and connected but the machine generally takes it as two different things * So the researchers have been building tools that takes the different modes of speech (image, text) in a specific piece of information and then bombard them at the initial stage of the classification process * So, there are 3 types in a meme content: Text Dominant content, Text and Image Dominant Content, Image Dominant content * So, we are working on the middle category which is Image and Text Dominant content * This data is made available to the public so that anyone can build an efficient model in order to solve this multi modal Speech classification | * The competition is hosted on Driven Data * It is created with the help of Getty images * You can go to this link and download the data and start building a model to classify the meme content: <https://www.drivendata.org/competitions/64/hateful-memes/> * Once if a model is successfully built, you can use that model for various applications in the NLP to solve and classify the content posted on social media * This will certainly help the social networking companies to utilize it for the recommendation engine for offering a better and appropriate service to the customer |
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