1 Project Overview

We propose a machine learning system especially for neural network construction to tackle the heterogeneity in mainstream machine learning platforms, e.g. TensorFlow and PyTorch. The proposed project is based on the abstraction of mainstream machine learning platforms, including TensorFlow and PyTorch. By adding abstraction layer for each specified platform API, different levels of network structures abstractions, including blocks and layers, are available for further model construction. By linking with a specific machine learning platform, the code generation and simple network structure logical debugging are achievable. On top of the abstraction layer, the network visualization techniques with user interaction are deployed for easy network structure construction for principle network structures, such as CNN, DNN, and RNN. By adding abstraction for macro network structures, such as data input and layer type, an extensible network generation system can be built. With available hardwares imported, the hardware attachment for network training is possible, which is expected to be utilized in cluster deployment or local test.

2 Related Works

TensorFlow provides TensorBoard for simple visualization for neural network structures. TensorBoard can be treated as the state-of-art for related projects, which uses visualization techniques to simplify progress in model construction. However, this tool is more like an after-training tracker, monitoring the loss and analyzing the already-designed network structures. Although there is extra support for data distribution visualization and the loss variation within training, the intersection with our proposed project is limited. And the one we proposed tries to construct the network, instead of studying the constructed ones. But TensorBoard provides insights about corresponding visualization abstractions, such as layer naming and data flow. Azure Machine Learning Studio also try to provide visualization interface for machine learning models. But with too-simplified visualization techniques, which is good for data flow but not neural networks, this tool can't provide actual support. Also, it is not built on a mainstream machine learning platform, limiting its acceptance.

1. TensorBoard [2]
2. Tensorflow: A system for large-scale machine learning [3]
3. PyTorch: An imperative style, high-performance deep learning library [4]
4. Azure Machine Learning Studio [1]

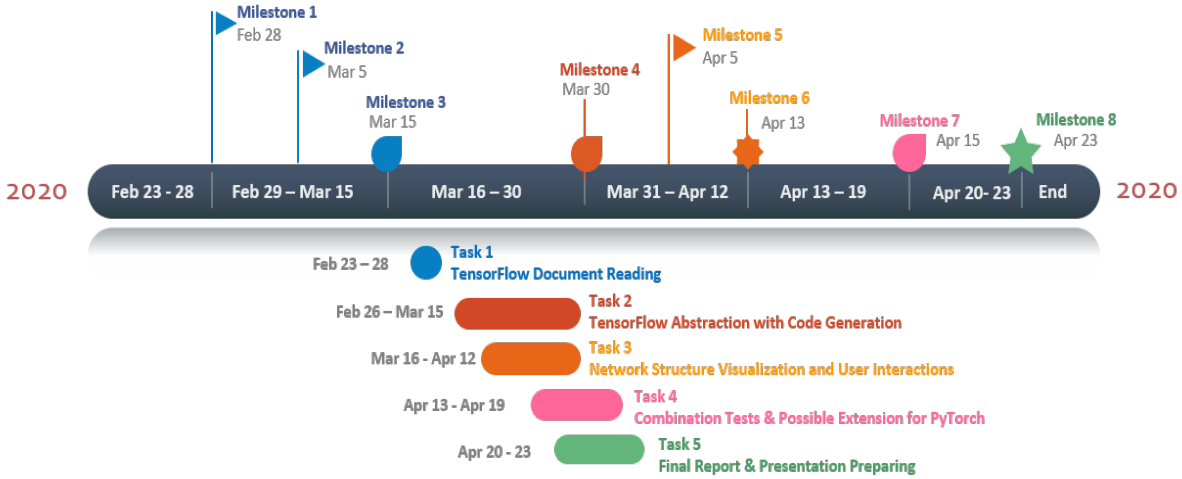
3 Falsifiable Hypothesis

1. Visualized programming for neural network and user interactions are achievable.
2. A unified representation format for neural network model is retrievable.
3. Above-layer abstraction can speedup model construction and pattern re-usage.
4. Higher level debugging with possible fine-grained hardware assignment can be solved in an easy way with visualization.

4 Expected Contributions

1. Abstractions for easy network construction with visualization of network structure and possible data flow
2. Simple debug interface with modification suggestions for designed network structure
3. Modular design for building multiple principle neural networks, i.e. CNN, DNN and RNN
4. Unify the heterogeneity in neural network construction for mainstream ML platforms with abstraction layer and code generation

5. Provide hardware configuration options for constructed network structure (possible supports for cluster deployment)



References

[1] Azure machine learning studio. `https://docs.microsoft.com/en-us/azure/machine-learning/studio`. Accessed: 2020-02-20.

[2] Tensorboard. `https://www.tensorflow.org/tensorboard/graphs`. Accessed: 2020-02-20.

[3] Martín Abadi, Paul Barham, Jianmin Chen, Zhifeng Chen, Andy Davis, Jeffrey Dean, Matthieu Devin, Sanjay Ghemawat, Geoffrey Irving, Michael Isard, et al. Tensorflow: A system for large-scale machine learning. In *12th {USENIX} Symposium on Operating Systems Design and Implementation ({OSDI} 16)*, pages 265–283, 2016.

[4] Adam Paszke, Sam Gross, Francisco Massa, Adam Lerer, James Bradbury, Gregory Chanan, Trevor Killeen, Zeming Lin, Natalia Gimelshein, Luca Antiga, et al. Pytorch: An imperative style, high-performance deep learning library. In *Advances in Neural Information Processing Systems*, pages 8024–8035, 2019.