



Project Proposal Template

Project Management and Software Development
for Medical Applications

General Info

Project Title: Deployment of deep learning CNN based algorithms to a mobile app

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Project Abstract

Deployment of deep learning CNN based algorithms to a mobile app. Within this app it should be possible to use your self-trained model on new examples. The app will be presented on a symposium for medical students in January 2020.

Background and Motivation

At university we learn everyday how important ML will be in the future and learn every detail how to slightly improve the accuracy of our Deep Learning (DL) models. This is all very important for the development of state of the art DL algorithms but when you tell a non-technical person about your work, they might be more interested in the real world application rather than theoretical details.

This PMSD project deals with the deployment of Machine Learning (ML) models to handheld devices. Once you uploaded your freshly trained model, you should be able to simply take a picture with your camera and run the model. Your picture will be used as input of the model and you will see your prediction result on the phone.

A good example of such an app is the age changing app FaceApp [1]. Faceapp uploads your custom image to a server (in the USA or Russia) runs the requested Image AI transformation on the server and sends the resulting image back to your phone so you can show it to your friends. But with the new generation of smartphones, it might also be feasible to run the network directly on your phone [2]. Also, in contrast to FaceApp the users should be able to upload their own self-trained models to the app or be able to choose the right model in a web app by logging in.

This app will be very interesting for bringing Deep Learning application to live and it will be an easy way to show your friends, family or supervisors what you are currently working on.

At the medical school at TUM, we are running a course for medical students to teach them how to train their own melanoma classification DL framework. At the end of the course, each student should have their very own melanoma classification network. In the first week of January 2020 we will host a symposium for the students and we would like you to present the app there. This is a perfect opportunity to meet exiting people at Klinikum Rechts der Isar that are interested in working with talented engineers.

Please send the completed proposal to beatrice.demiray@tum.de, javier.esteban@tum.de and hendrik.burwinkel@tum.de.
Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.



Student's Tasks Description

Tasks:

- Analyze the two biggest ML frameworks (Pytorch [3] and Tensorflow [4]) to understand best practices on how to export a trained model and deploy it on a remote server or locally on a smartphone/tablet.
- Decide whether to run the models on a server as web app or directly on the smartphone/tablet. If you choose to work directly on the smartphone/tablet check out the CoreML framework [5] and the NNAPI for Android [6] or ONNX [8]. If you decide to run it on a centralized server have a look at docker containers to run the models securely.
- Depending on your experience and decisions design the app with an appealing frontend and a functioning backend that runs the examples through the network (e.g. Flutter, React Native [7]).
- Prepare a presentation for the symposium and incorporate a manual into your app to guide new users when they try your app the first time.
- Design multiple test networks (limited to pictures as input, CNN) and test your app. An easy choice would be MNIST or the melanoma classification app designed by the medical students.
- Document your work and version your code.

During this project you will get a broad overview of existing ML frameworks and understand differences and similarities between them. You will learn how to realize novel and innovate ideas and about the main challenges of this task. You will either get a deep insight into a centralized server backend or a framework for mobile devices for ML. You will work in the IFL lab, in the center of Munich, together with multiple other masters and PhD students and will be able to share your thoughts, ideas and problems within the team. You will learn how an agile development project is executed and how to present your technical ideas in front of a medical audience.

Technical Prerequisites

List all the required technical knowledge that the student should bring as a prerequisite, including e.g. proficiencies in programming languages (500 characters).

- Theoretical knowledge in existing DL methods and techniques (introduction into DL course)
- Programming experience in Python (TF and/or Pytorch) and an additional language (JavaScript, C++,...)
- Knowledge with Unix systems (ssh, docker, terminal)

References

- [1] <https://www.faceapp.com>
- [2] <https://medium.com/syncedreview/huawei-leaps-into-ai-announces-powerful-chips-and-ml-framework-f9aa6ec87bcb>
- [3] <https://pytorch.org>
- [4] <https://www.tensorflow.org>
- [5] <https://medium.com/@alexiscreuzot/building-a-neural-style-transfer-app-on-ios-with-pytorch-and-coreml-76e00cd14b28>
- [6] <https://developer.android.com/ndk/guides/neuralnetworks>
- [7] <https://flutter.dev> | <https://facebook.github.io/react-native/>
- [8] <https://onnx.ai>