CS 475/675 Project Proposal

Chang Yan, Jingguo Liang
cyan13, jliang35

Abstract

The abstract should consist of two sentences describing the motivation for your project and your proposed methods.

1 Project choice

Choose either a **methods** or **applications** project, and a subarea from the below table.

☐ **Applications**				
☐ Genomics data	☐ Healthcare data	☐ Text data	☐ Image data	☐ Finance data
☐ **Methods**				
☐ Fairness in ML	☐ Interpretable ML	☐ Graphical Models	☐ Robust ML	☐ Privacy in ML

2 Introduction

Explain the problem and why it is important. Discuss your motivation for pursuing this problem. If necessary, give some background on published work in this related area. Clearly state what the input and output is. Be very explicit: "The input to our algorithm is an English sentence, image, etc.. We then use a SVM, neural network, linear regression, etc. to predict COVID case count, text sentiment, etc.." This is very important since different teams have different inputs/outputs spanning different application domains. Being explicit about this makes it easier for readers. 1-2 paragraphs.

3 Dataset and Features

Describe your dataset(s): how many training/validation/test examples do you have? What pre-processing did you do? What about normalization or data augmentation? What is the resolution of your images? How is your time-series data discretized? Include a citation for the dataset(s) you are using. You should also talk about the features you used. If you extracted features using Fourier transforms, word2vec, PCA, etc. make sure to say so. If you have space, include one or two examples of your data in the report (e.g. include an image, a slice of a time-series, etc.). 1-2 paragraphs.

4 Methods

The hypothesis class would be the deep convolutional networks that we designed or modified from other models, and we also plan to use an ensemble with multiple different network structures to boost the performance. A 5-fold cross validation will be used to evaluate the performance.We would use cross entropy loss as our first try, and we plan to try others like a MSE loss or combination of cross entropy and MSE. Our hypothesis is that it would be better to use MSE to predict age (as age would be a real-number), and cross entropy loss would be better for predicting sex and ethnicity as classes. The simple optimization would be hyperparameter tuning and changing of the nextwork structurs, and we also plan to use ensemble of multiple networks and/or attention models, neted structures, semi-supervised learning, etc. to better optimize it. Moreover, we would try feature engineering: The raw data has 3 channels, RGB, and we plan to add more features like intensity, edge detection, etc. to improve the performance. Also, as the dataset provides key points, we could potentially first register all the image to the same space using the key points, creating transformations of each image to a standard space, and then input the transformed image (which are in the same sapce now) to the networks. This would account for the projective deformation in the images and produce better performance.

5 Deliverables

These are ordered by how important they are to the project and how thoroughly you have thought them through. You should be confident that your "must accomplish" deliverables are achievable; one or two should be completed by the time you turn in your Nov 19 progress report.

5.1 Must accomplish

1. A program with a trained deep convolutional network with optimized structure and best tuned parameters, that can predict the age of the face in the input image
2. The prediction of the program should be distinctly better than simple benchmark run, like a logistic regression.
3. The program should use appropriate data preprocessing mothods to improve the performance.

5.2 Expect to accomplish

1. The program should be able to predict not only age but also sex and ethnicity of the face.
2. The program should use multiple different network structures, ensembles or other methods to further improve the performance.
3. The prediction of the program should reach an accuracy that is usable in real-life, like over 90%,.
4. Adding feature extraction methods before the network (like edge detection) to create more features from the image.

5.3 Would like to accomplish

1. The program should be able to first identify the location of the face in the image, and then predict using the cropped face area. The position of the face should also be an output.
2. The program should be able to take in different sizes of image files.
3. The program should be able to identify an image with no face, instead of giving random output.
4. The program should work with both RGB and grayscale images, and uses the RGB channels to achieve better performance than grayscale.
5. The speed of the prediction should be fast enough to be done in real-time.

References

This section should include citations for: (1) Any papers on related work mentioned in the introduction. (2) Papers describing methods that you used which were not covered in class. (3) Code or libraries you downloaded and used.

[1] Alexander, J.A. & Mozer, M.C. (1995) Template-based algorithms for connectionist rule extraction. In G. Tesauro, D.S. Touretzky and T.K. Leen (eds.), *Advances in Neural Information Processing Systems 7*, pp. 609–616. Cambridge, MA: MIT Press.

[2] Bower, J.M. & Beeman, D. (1995) *The Book of GENESIS: Exploring Realistic Neural Models with the GEneral NEural SImulation System.* New York: TELOS/Springer–Verlag.