Aprendizagem Automática Avançada - Project Proposal - 2022/23
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Gender Detection using Facial Features with Support Vector Machine

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Goal

Our proposed work will be inspired by a paper from Hiremath et al. (2022) that used a support vector machine (SVM) to determine human gender using face photographs of various ages. In this paper, the authors obtained a model with 91.63% accuracy. The SVM used in this paper was an SVM-Classifier using an RBF Kernel.

In this project, the technique used in the above-mentioned paper will be replicated, and the results will be compared. One crucial aspect was noticed, the authors used an algorithm called SURF for feature extraction, which requires license/permission from the creators. For this phase alternatives such as the library PIL or OpenCV will be considered for this phase.

Also, other techniques, like Convolutional Neural Networks and SVMs using other kernel functions, will be applied to try to solve the same problem and compare the result in order to see if a better algorithm for this type of problem and data can be found. For this model, parameter tuning will be applied.

A complementary analysis is also proposed, which is the classification by age apart from gender, which is the only one done in the mentioned paper.

Tools

For this project, Python3 will be used through Jupyter Notebook. To enact pre-processing of the data, and selection of samples, we will also use scikit-learn, pandas and NumPy for things like evaluating models (model metrics). Furthermore, we will employ matplotlib/seaborn for visualising results. To create models, we will use scikit-learn for SVM, *Keras* from *Tensorflow* for Convolutional Neural Networks, and other libraries like PIL for things like displaying and transforming images into arrays on since the dataset is comprised of only images.

Data

To meet this project goal, the dataset used in the mentioned paper will be used. The dataset used will be *UTKFace*, which is a dataset that consists of more than 20,000 pictures of 200 by 200 pixels (these will be the features of the dataset) of faces that vary in terms of gender (0 for male, 1 for female), age (from 0 to 116 years old) and ethnicity, with these characteristics detailed in each image's file name. The images cover significant variations in pose, facial expression, illumination, occlusion, resolution, etc. The dataset will be taken from the Kaggle platform and is available through this link: https://www.kaggle.com/datasets/jangedoo/utkface-new?datasetId=44109

Data Problems

Some problems we are bound to face include the sheer volume of, not rows of numbers or strings, but of images which by default are larger in how much memory it takes to store each

one, but also the fact that this set holds more than 20,000 of these. For this, only a fraction of the images will be used, which will still be determined. We intend to analyse the distribution of the photographs based on the two relevant factors for our goal, the age and the gender of the person and have this distribution be as balanced as necessary for each range of ages and whether the person is male or female. We will bin the photos according to predefined age intervals for both genders and use a subsample of each to achieve this goal.

Other aspects we need to pay attention to may be the data pre-processing, given that the images cover considerable variation in pose, facial expression, illumination, occlusion, resolution, etc. The authors normalised the images which will also be considered.

Bibliography

Hiremath, J. S., Hiremath, S. S., Kumar, S., Chincholi, M. S., Patil, S. B., & Hiremath, M. S. (2022). Gender Detection using Facial Features with Support Vector Machine. *2022 IEEE 2nd International Conference on Mobile Networks and Wireless Communications (ICMNWC)*, 1–6. https://doi.org/10.1109/ICMNWC56175.2022.10031856