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GESTALT INTEREST POINTS WITH A NEURAL NETWORK FOR MAKEUP-ROBUST FACE RECOGNITION

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INTRODUCTION

- Novel approach for the domain of makeup-robust face recognition.
- Various real-world applications, for example automated passport control, security in general, and surveillance.
- We evaluated our method empirically with a selfcompiled dataset composed by YouTube makeup tutorials.
- Baseline algorithms: SIFT+NN, SURF+NN, BRISK+NN, FREAK+NN, CNN

PROPOSED APPROACH

Fig. 1. Before (top line) and after (bottom line) makeup examples of four subjects containd in our makeup dataset.

- Our proposed method is, on the one hand, inspired by the following three visual perception theories and by biological neural networks, on the other hand.

1. The psychologist David Marr described visual perception as a multistage process (edges, textures, 3D model).

2. The physicist Hermann von Helmholtz examined in his work about visual perception that the information gathered via the humaneye is a very simplified version of the real world.

3. Gestalt psychology is an attempt to understand the laws behind the ability to acquire meaningful perceptions in an apparently chaotic world (8 Gestalt Laws).

- Our proposed approach is a combination of Gesalt Interest Points (GIP) feature extraction with ANN classification (GIP-NN). GIP and ANNs are both inspired by cognition. Therefore, the logical consequence was to combine both concepts into a powerful recognition system.

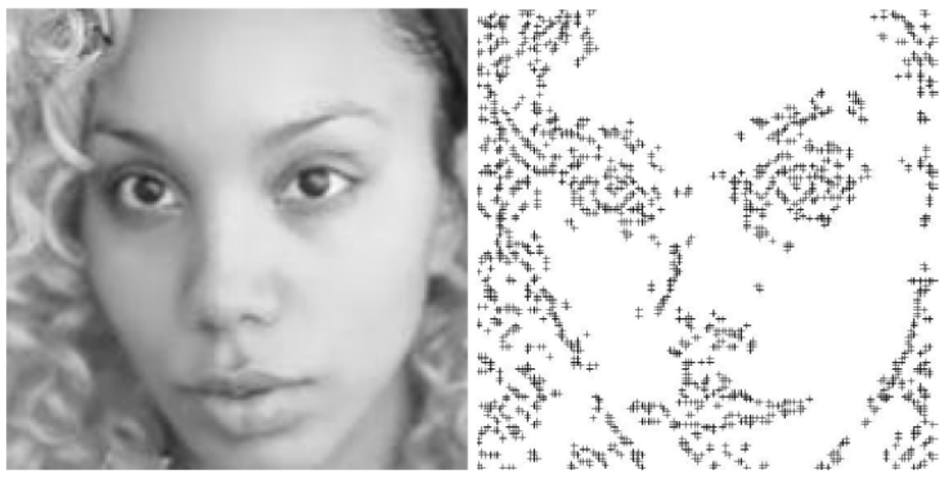

Fig. 2. A face image on the left and its GIP representation on the right. The GIP algorithm is fast and highly effective. Because it is inspired by cognition it extracts very little, but well-selected image information.

RESULTS

- We conducted an experiment for exploring the effectiveness of the GIP-NN method in matching after-makeup against before-makeup face samples and for comparing our approach to the different baseline methods.

- No overlap between training images and test images

- Training: 19,635 non-makeup face images of 26 subjects

- Classification task: assign each of the 3,510 makeup test images to one of the 26 subjects

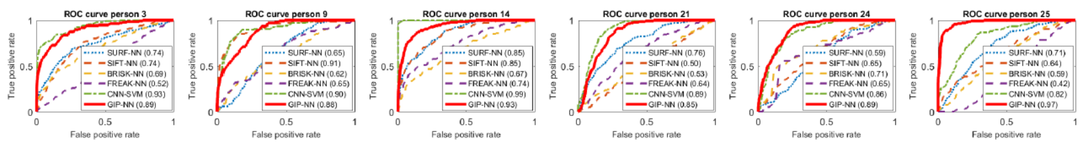

Fig. 3. ROC curves of our experiments for 6 of the 26 subjects. The numbers in parentheses in each legend indicate the Area Under the Curve (AUC) values.

- In Figure 3 some example ROC curves are shown. For subject 14 the CNN-based baseline method is the most accurate but for subject 25 our method clearly outperforms all the baseline methods. The subjects 3, 9, 21 and 24 are a big challenge for all methods.

- Figure 1 shows that even for human beings it is difficult to identify these people because the make-up changes their faces drastically.

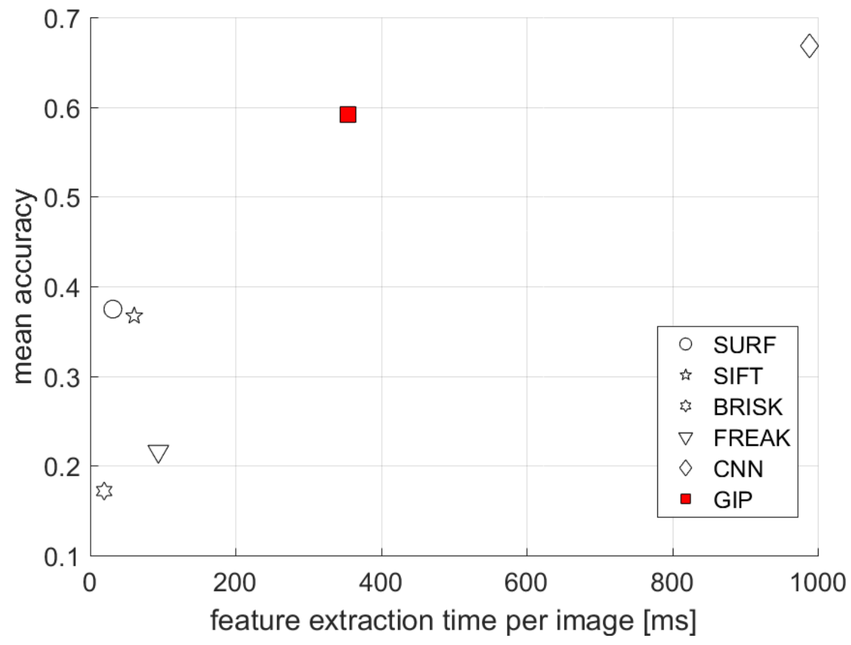

Fig. 4. The mean accuracies over feature extraction time of the different methods.

- Figure 4 compares the mean accuracies over feature extraction time of the different methods. GIP-NN is cleary more accurate than all the hand-crafted feature extraction algorithms, yet with 59.5 percent less accurate than the CNN-based method with 68 percent. But the CNN-based method is significantly slower than the proposed approach.

- Experiment runtime GIP-NN: 2 hours
- Experiment runtime CNN: 5 hours

- The GIP algorithm describes images more compactly than all the other feature extraction baseline methods. That is, we need less disk space and processing power. This is very beneficial for a big data domain like face recognition.

CONCLUSION

In this work we introduce a novel approach for makeup-robust face recognition based on the GIP algorithm and an artificial neural network. The approach is, on the one hand, inspired by visual perception and by biological neural networks, on the other hand. We evaluated our method empirically with a self-compiled dataset composed by YouTube makeup tutorials of 26 subjects. Our experiments showed that GIP-NN is very accurate and almost three times faster than the CNN-based baseline method. Especially for surveillance fast and accurate face recognition is essential. We demonstrated that our method is highly effective for the domain of makeup-robust face recognition.

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