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The Importance of Hyperparameter Optimisation for Facial Recognition Applications

Introduction

- **51% of all countries worldwide** already utilise facial recognition technologies [1].
- However, most of these technologies misclassify **34.7% of darker-skinned females**, compared to 0.8% of lighter-skinned males [2].

What can be changed?

Methodology

- Focusing on the optimisation of the most important parameters, **4 methods** were implemented.
- The dataset (**Yale Face Database**) contained 1500 images of 30 different people, 50 images each in different lighting conditions [3].

Examples:

Implementation

1. Manual Optimisation

Manually trying every possible combination in a defined range.

2. Grid Search

Automated process to try every possible combination in a defined grid.

3. Random Search

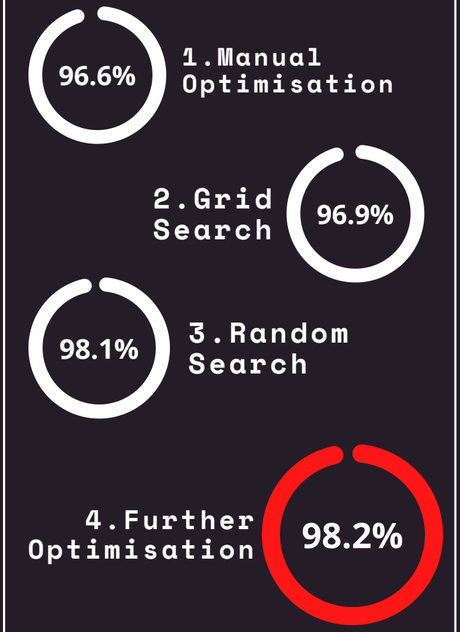
Automated process to try random possible combinations in a defined range.

4. Further Optimisation

Combining automated optimisation and manual optimisation.

Results

The best average recognition accuracies



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Conclusion

1. Optimisation is important in order to implement a safe facial recognition application worldwide.
2. Diversity within the training dataset matters, so that bias and errors can be minimised.
3. Questions need to be answered and new laws and regulations have to be created.

Issues

- There are still a lot of **unanswered questions**, i.e.:
  - Who owns the data?
  - Who is responsible for misclassification and its consequences?
  - What behavioural changes will we see in our society?
  - What changes need to be made in law enforcement?
- Most of the current applications were trained with **biased datasets**, which can create a bias against or in favour of specific groups [2].

Analysis

- The recognition accuracy could be **improved** by **+1.6%**
- The error was **minimised** from 30% to **<1%**
- There is not one single set of optimal hyperparameter values, but a **range of values**.
- Through optimisation, the application can successfully be **implemented worldwide**.

References:

[1] Carnegie Endowment for International Peace. (2020). AI Global Surveillance.

[2] Buolamwini, J., Gebru, T., Friedler, S. and Wilson, C. (2018). Gender Shades: Intersectional Accuracy Disparities in Commercial Gender Classification. Proceedings of Machine Learning Research, 81, pp.1-15.

[3] Belhumeur, Peter N. and David J. Kriegman. "The yale face database." (1997).