Machine Learning Assignment 2

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Multi-Person Pose Estimation with Local Joint-to-Person Associations

In this work, we analyse methods discussed in the paper that can estimate the poses of multiple persons in an image, even when they are occluded or truncated.

The method uses a densely connected graphical model and integer linear programming to solve the joint-to-person **association** problem.

Here is the link to the paper :

https://arxiv.org/abs/1608.08526v2.

Here is the link to access our implementation : https://colab.research.google.com/drive/14aLspmK2MbTUmECW-GvT5M4kQBaAvbKn?usp=sharing

Introduction

The paper proposes a method for estimating the poses of multiple people in an image.

The method uses a densely connected graphical model and integer linear programming to solve the joint-to-person association problem.

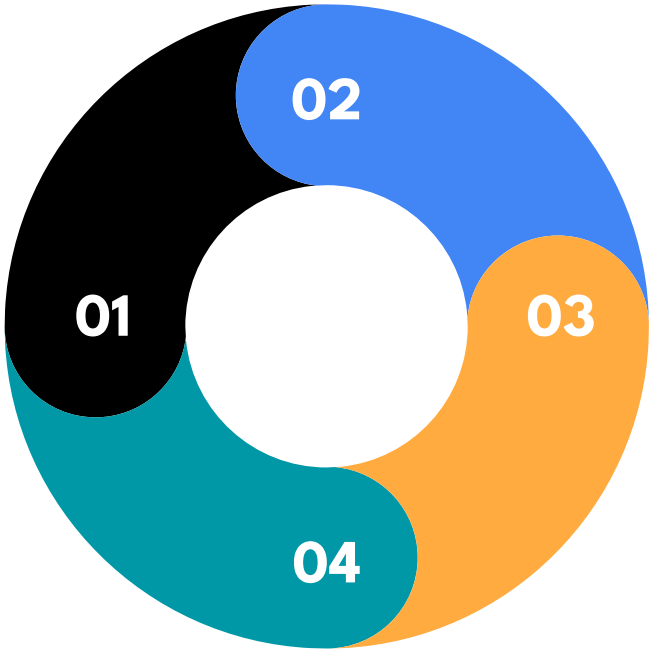
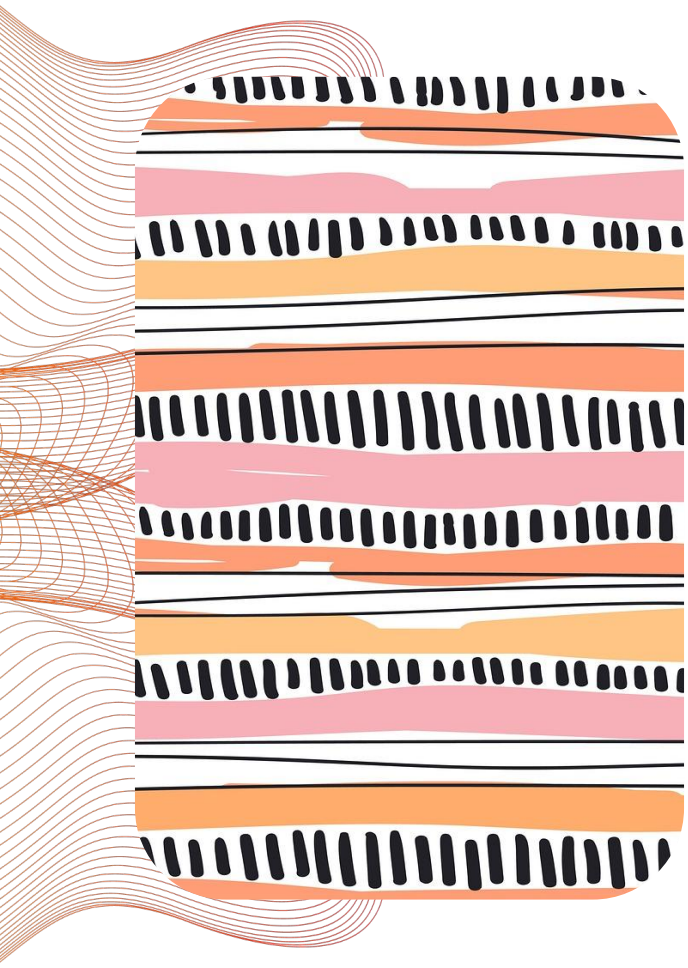


Image regions are cropped around each person and the joint-to-person association is solved for the person in the center of each region.

The labeling of the joints and non-maxima suppression are directly performed by a convolutional neural network.

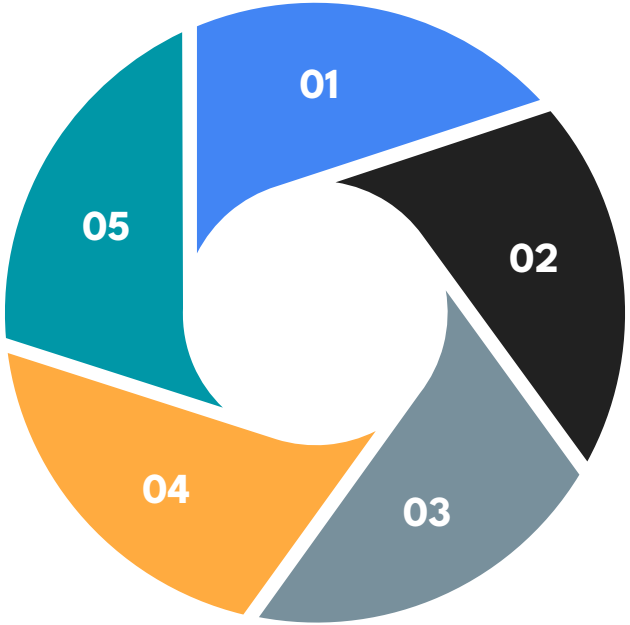


Related Work

- The paper discusses related work in human pose estimation, including earlier approaches that formulate the problem in a graphical model and more recent approaches that use convolutional neural networks.
- The paper concludes that graphical models are of little importance in the presence of strong part detectors and that multistaged CNN architectures can be used to learn image-dependent spatial relationships between parts.

Experimental Results

Using only the CPM to estimate the pose of each detected person achieves 45.2% mAP and takes only 2 seconds per image.



The proposed method achieves an accuracy of 54.7 seconds on the MPII Human Pose Dataset for multiple persons.

The proposed method reduces the runtime by a factor between 6,000 and 19,000 compared to previous methods.

Using the proposed Local Joint-to-Person Association (L-JPA) model with 1 detection candidate per joint (N = 1) to suppress the incompatible detections improves the performance from 45.2% to 49.2% with a very slight increase in run-time.

Increasing the number of candidates per joint increases the accuracy only slightly. For the following experiments, we use N = 5.

Results

01 The proposed method is thousands of times faster than previous methods.

02 The proposed method achieves state-of-the-art accuracy on the MPII Human Pose Dataset.

https://github.com/capstone-project-SECURIX/ml-projects/tree/main/Ass3-Association

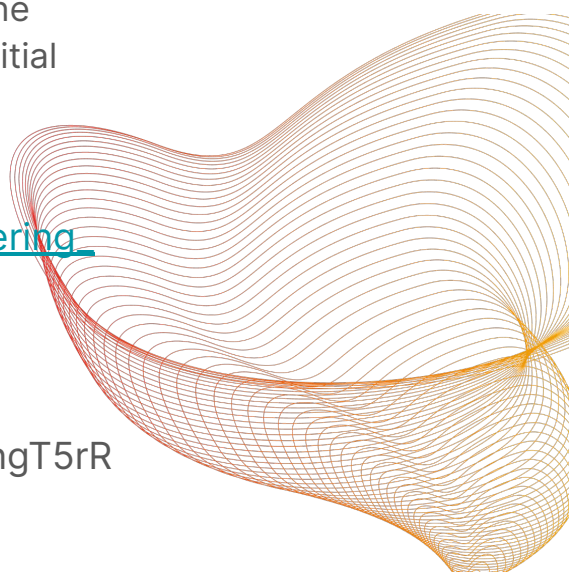
A Clustering Method Based on K-Means Algorithm

The paper titled "A Clustering Method Based on K-Means Algorithm" by Youguo Li and Haiyan Wu proposes an improved K-Means clustering algorithm by combining the largest minimum distance algorithm with the traditional K-Means algorithm. The improved algorithm addresses the shortcomings of the traditional K-Means algorithm in determining initial focal points, thus enhancing cluster precision and stability.

Link to paper :
https://www.researchgate.net/publication/271616608_A_Clustering_Method_Based_on_K-Means_Algorithm

Link to Notebook:

https://colab.research.google.com/drive/11W1L5nTPAiEypl9-3ngT5rRAowwgg5Jr?usp=sharing

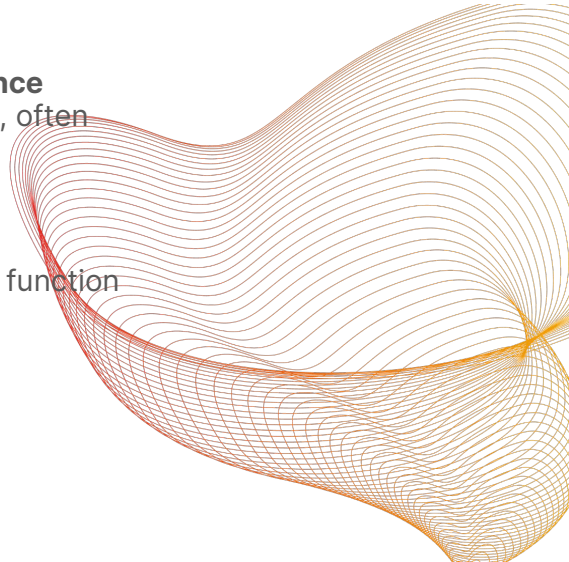


Introduction

1. Cluster analysis relies on differences between objects and utilizes distance functions to classify models. The authors propose an **improved K-Means algorithm** by combining the largest minimum distance algorithm with traditional K-Means, overcoming issues related to initial focal point selection.

2. K-Means is an unsupervised cluster algorithm that minimizes **cluster performance index.** It depends significantly on initial points and is sensitive to their selection, often leading to different outcomes.

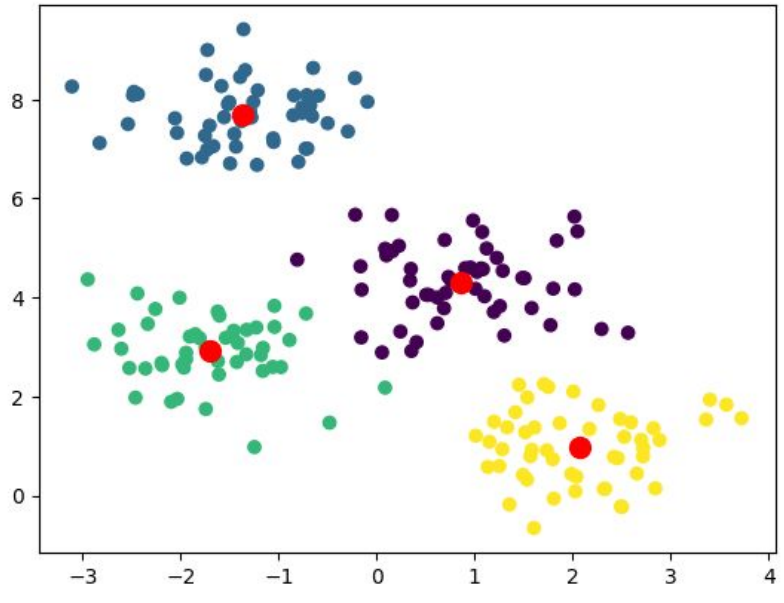
3. Euclidean distance measures the similarity of patterns, and the cluster criterion function quantifies the accuracy of sample classifications.



Improved K-Means Algorithm

1. The improved algorithm uses the largest minimum distance algorithm to determine initial cluster focal points intelligently. It selects points that are farthest apart as focal points, enhancing cluster precision and speed. The algorithm iteratively refines the focal points and classifies samples into clusters, optimizing the cluster criterion function.

2. The authors tested the improved K-Means algorithm using simulated data with obvious class differences. A comparison with standard K-Means demonstrated the improved algorithm's superiority in terms of stability and cluster precision



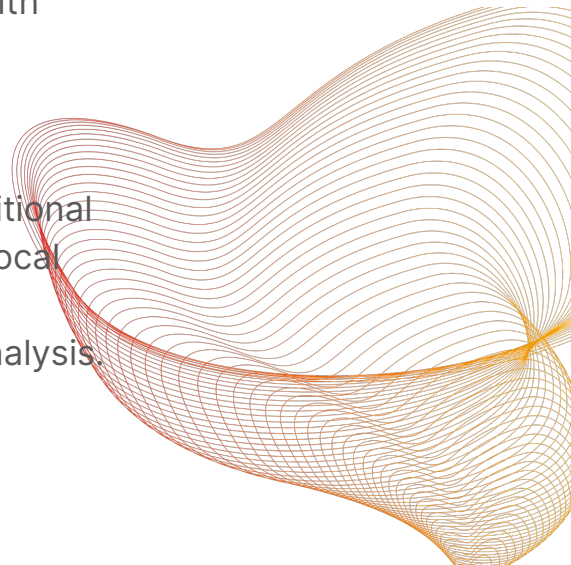

```
from sklearn.metrics impor
acc=accuracy_score(y, mode
print("Accuracy score is",
```

```
Accuracy score is 94.2 %
```

Conclusion and results

1. The study concludes that the improved K-Means algorithm effectively addresses the challenges related to initial focal point selection. It maintains the efficiency of standard K-Means while enhancing convergence speed and cluster precision, especially in scenarios with large-scale and randomly distributed data.

2. In summary, the proposed algorithm significantly improves the traditional K-Means clustering method by intelligently selecting initial cluster focal points. The experimental results validate the effectiveness of the approach, making it a valuable contribution to the field of cluster analysis.



Thank you for your time 😊