

# Face Detection summary

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# Face Detection

- Regression and Classification
- Face detection metrics
- DNN face detection

# Face Detection

- Face detection = classification + localization:
- Find:
  - **if there are faces** in a picture and
  - **where** they are (facial ROIs).

1<sup>st</sup> frame



6<sup>th</sup> frame



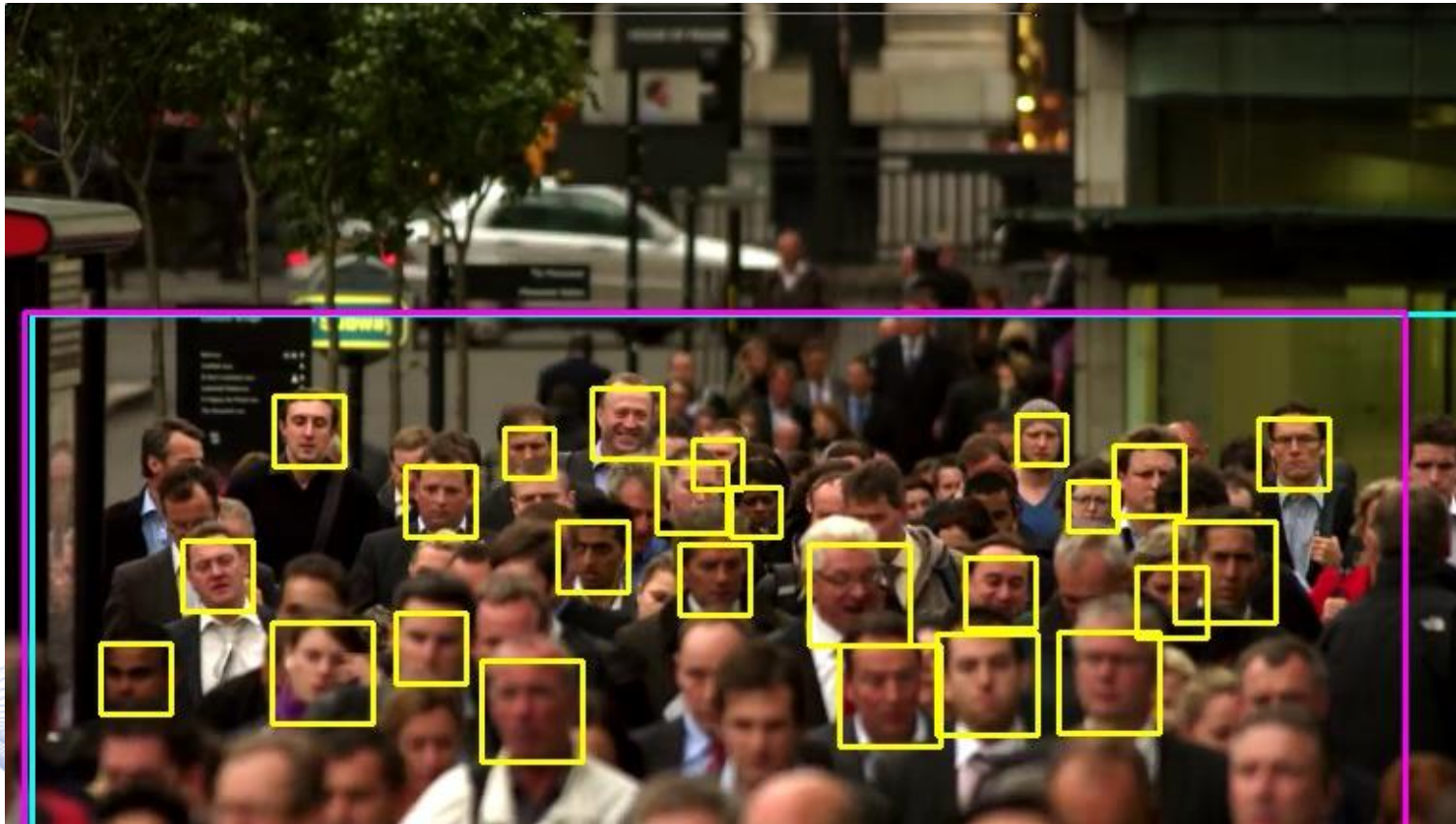
11<sup>th</sup> frame



16<sup>th</sup> frame



# Face detection examples





# Face Detection

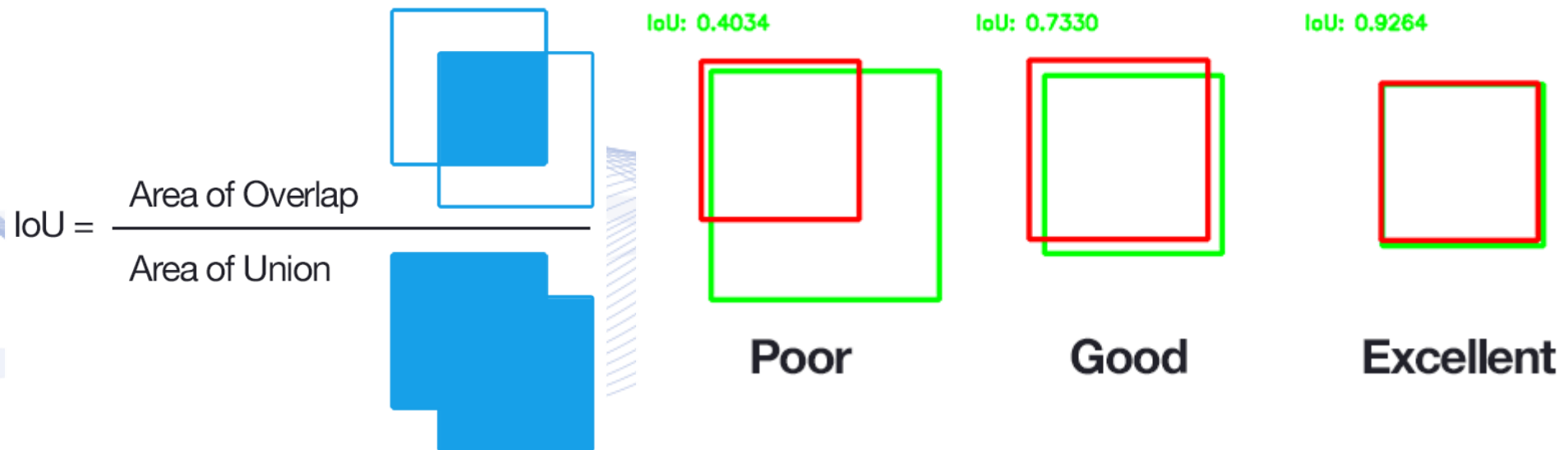
- **Input:** an image.
- **Output:** Facial Regions of Interest (ROIs) (bounding boxes).
  - Each image may contain a **varying number of facial ROIs**.
- Typical approach: train a **specialized classifier** and deploy in **sliding-window style** to detect all object of that class.
  - Very inefficient, quite ineffective.
- **Goal:** combine classification and localization into a **single architecture for multiple, multiclass object detection**.

# Face Detection Performance Metrics

- **IoU**: Intersection over Union of predicted ROI (bounding box)  $A$  with ground truth ROI  $B$ :

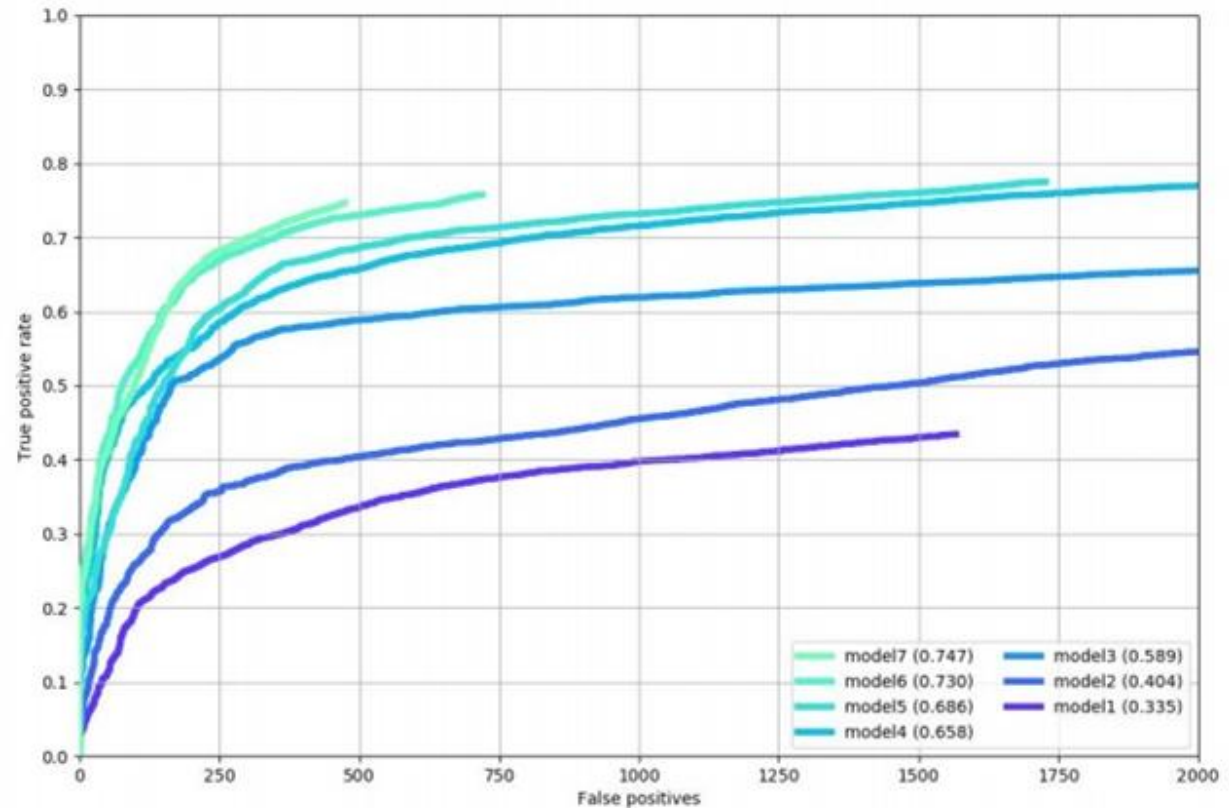
$$J(A, B) = \frac{|A \cap B|}{|A \cup B|}$$

- Also called **Jaccard Similarity Coefficient**.



# Face Detection Performance Metrics

- **False Positive (FP) vs True positive (TP) plots**, as a function of detection threshold e.g., for various training stages.
- The closer the curve is to the upper left corner, the better.



# Face Detection with CNNs

- Transformers
- Yolo
- Multi-Task Cascaded Convolutional Neural Network (MTCNN)
- Face-SSD



# Face detection examples



# Face detection examples





# Face detection examples



# Bibliography

- [PIT2021] I. Pitas, “Computer vision”, Createspace/Amazon, in press.
- [PIT2017] I. Pitas, “Digital video processing and analysis” , China Machine Press, 2017 (in Chinese).
- [PIT2013] I. Pitas, “Digital Video and Television” , Createspace/Amazon, 2013.
- [NIK2000] N. Nikolaidis and I. Pitas, “3D Image Processing Algorithms”, J. Wiley, 2000.
- [PIT2000] I. Pitas, “Digital Image Processing Algorithms and Applications”, J. Wiley, 2000.



# Q & A

**Thank you very much for your attention!**

**More material in  
<http://icarus.csd.auth.gr/cvml-web-lecture-series/>**

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