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Adaptive Frame Selection In Two Dimensional Convolutional Neural Network Action Recognition

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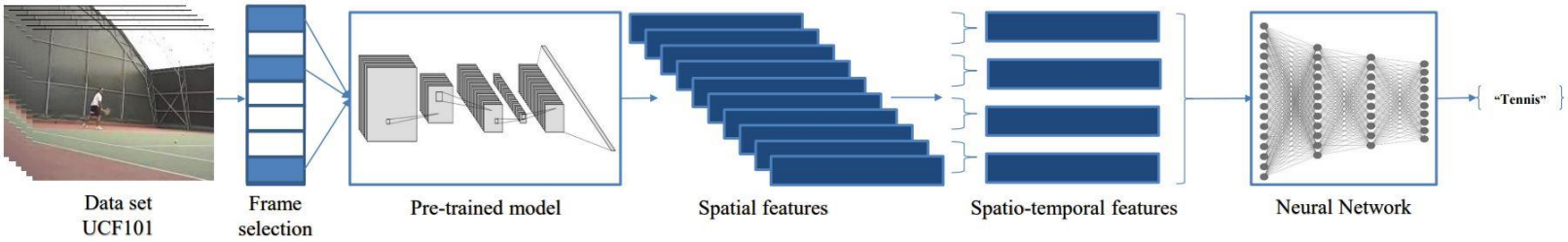
Introduction

- Video is the most important part of this contemporary society:
  - the majority of internet traffic
- Video usage :
  - Action recognition
  - Object detection
  - NLP
- Why do we use frame selection:
  - Redundancy
  - The large volume of data
  - Additional and unusable data
  - Less process

Introduction

An overview of the framework

- Dataset
- Frame-Selection
- Spatial feature extractor
- Temporal feature extractor
- Classification



Algorithm

Adaptive Frame-Selection

1. Read full video
2. Select the first frame
3. FS = Calculate the similarity frame of the last selected frame and the current frame with algorithm[1]
4. SFS = Calculate the average of the similarity frame
5. Check the current SFS with an average[2] of the SFS of all selected frames
6. If SFS_i < [2]Mean of the window:
   - Select the current frame and add SFS_i in the window array
7. Selected frames are used for feature extraction

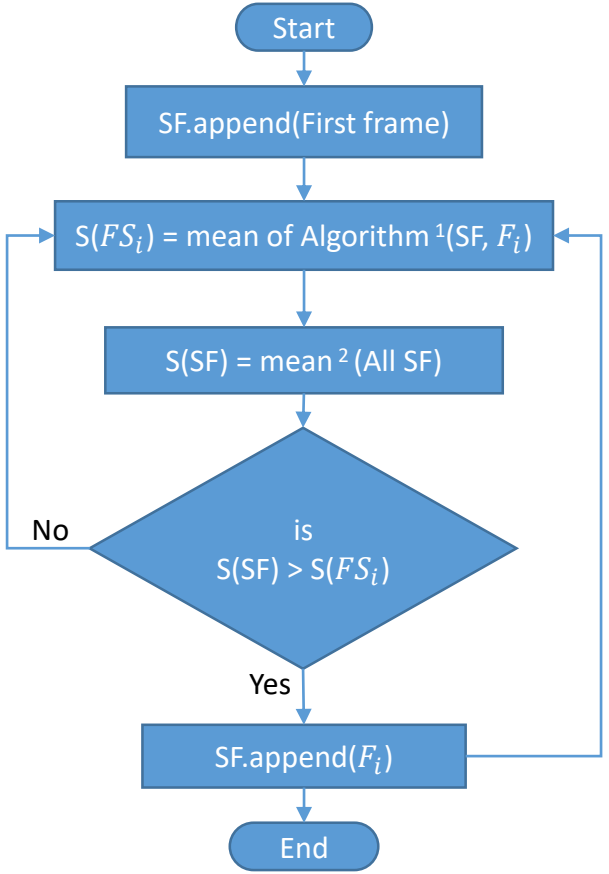
▸ [1] $Frame - Similarity = \frac{2 \times F_i \times SF_i}{F_i^2 + SF_i^2 + a}$

▸ [2] $Mean\ of\ window = \frac{\sum_{i=0}^{n} SFS_i}{n}$

Algorithm

Adaptive Frame-Selection

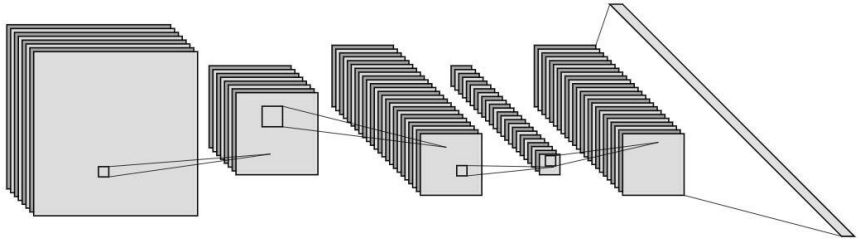
- $^{1}Frame - Similarity = \frac{2 \times F_i \times SF_i}{F_i^2 + SF_i^2 + a}$
- $^{2}\,Mean\ of\ window = \frac{\sum_{i=0}^{n} SFS_i}{n}$



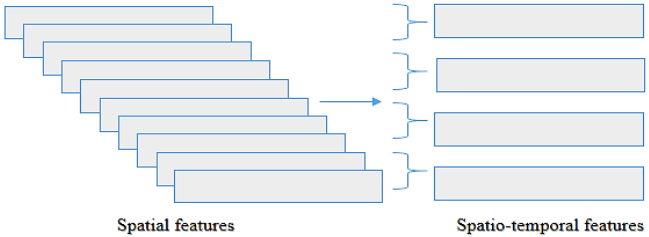
Feature Extraction

Spatio-Temporal pooling

- Spatial features:
  - Transfer learning
  - Pre-trained models:
    - ResNet-50
    - MobileNet

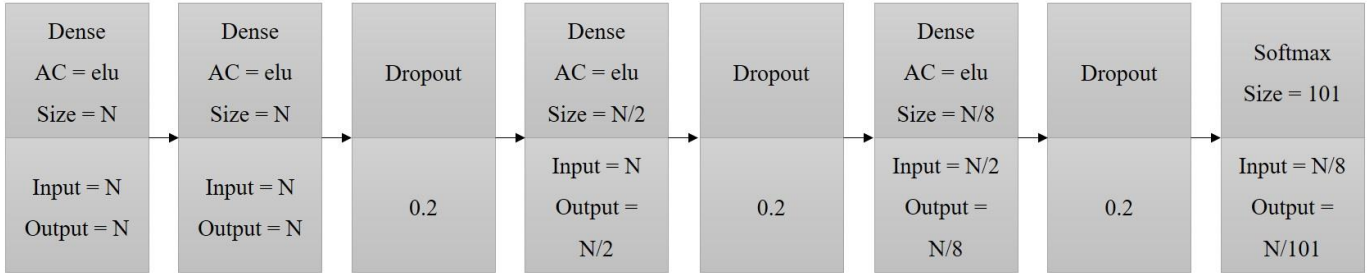


- Temporal pooling
  - Extract the maximum feature of the video
  - Data augmentation



Model

- Layers of Model:
  - Based on the feature vector size

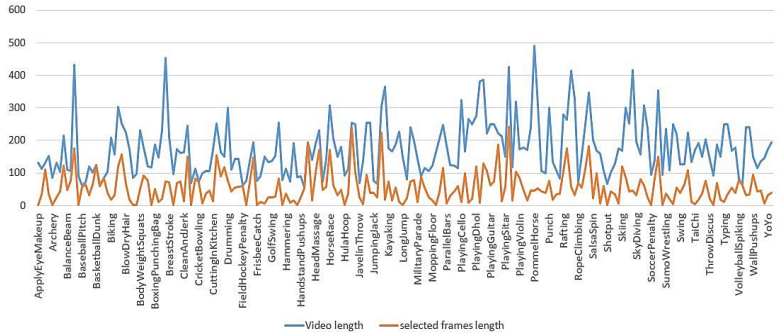


Results

Algorithm

COMPARISON OF TWO SCENARIOS: WITH OR WITHOUT FRAME SELECTION

Measurements	Selected frames	All frames
Total Frames	732,477	2,465,430
Time Spend Average	12.1650 Sec	37.3013 Sec
Selected Frames Average	55.1831	186.5065
percentage of the selected frame	31.2048 %	100%

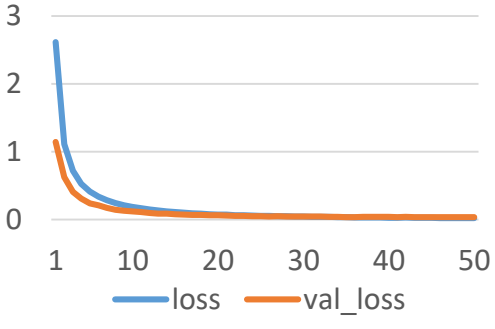


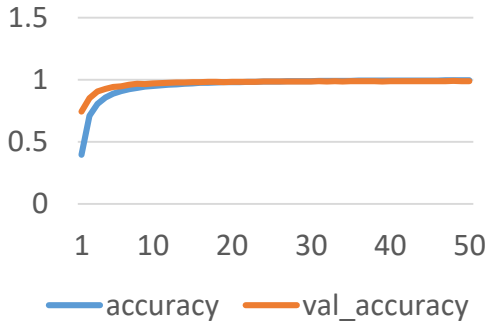
Results

Train&Test

RESULTS WITH A DIFFERENT PRE-TRAINED MODEL ON UCF101

Pre-trained models	All frames	Selected frames
ResNet-50	98.37%	98.05%
MobileNet	97.68%	97.70%



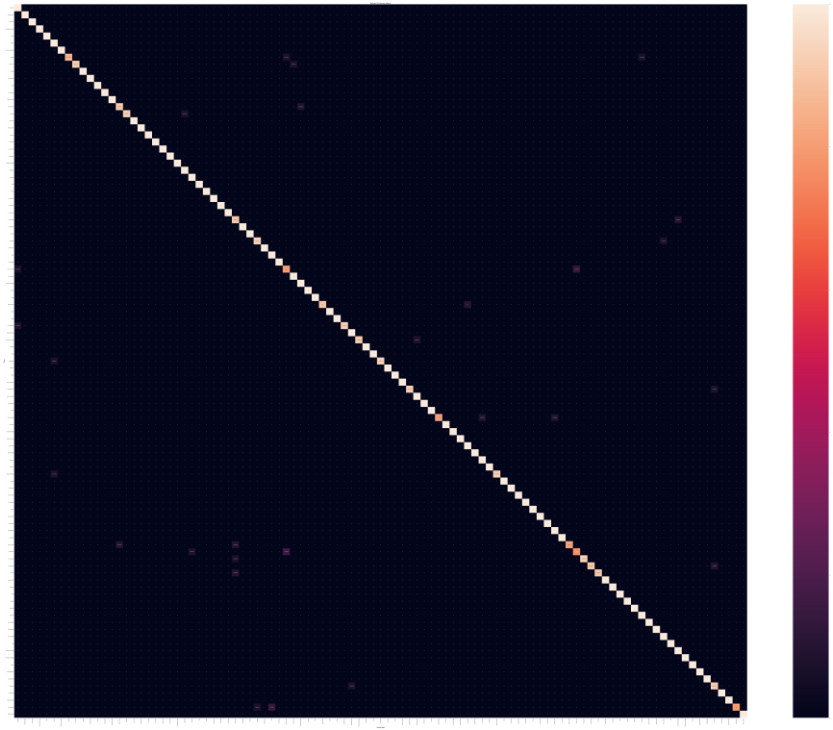


Conclusion and future work

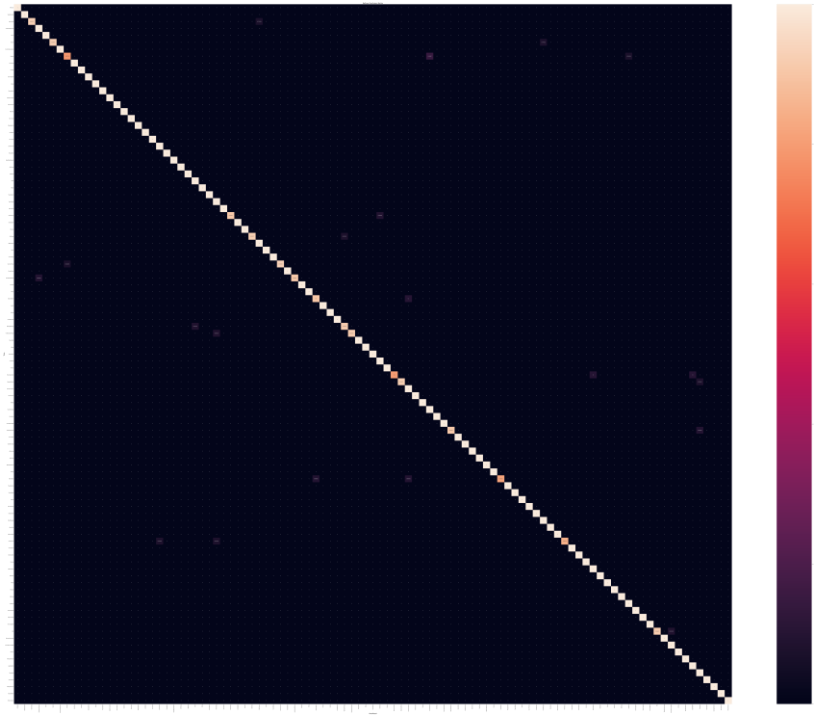
- Process in a shorter time
- Use data in compressed domain
  - Less process
  - Short time

Extra Result

Confusion Matrix



MobileNet



ResNet-50

Thanks for your attention

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