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Adaptive Frame Selection In Two Dimensional Convolutional Neural Network Action Recognition

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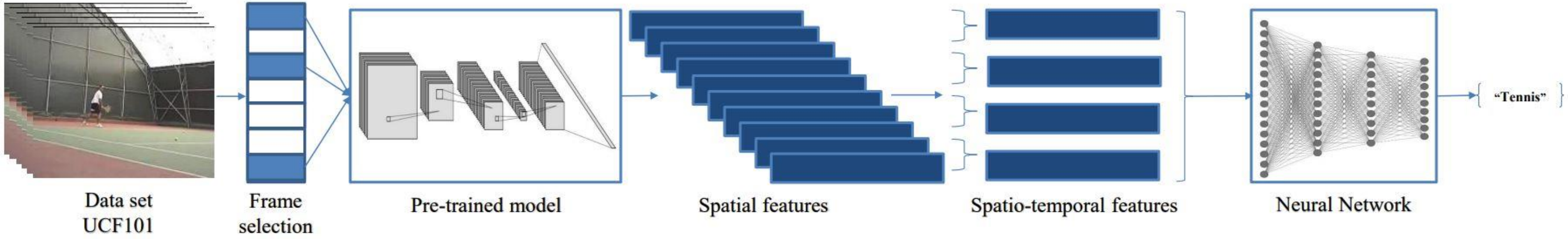
Introduction

- 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

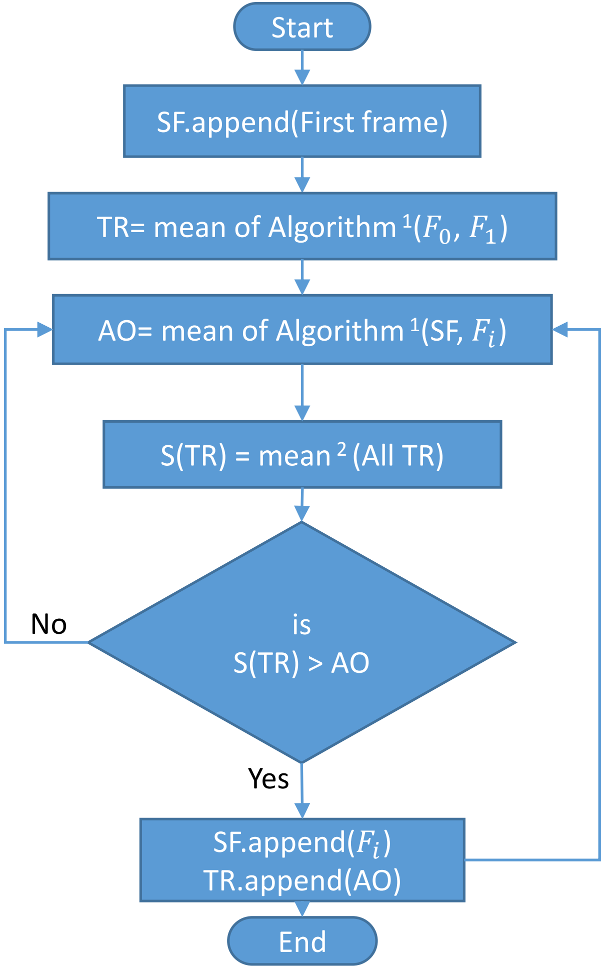
- $^1Frame - Similarity = \frac{2\times F_i\times SF_i}{{F_i}^2+{SF_i}^2+a}$
- $^2\,Mean\ of\ window = \frac{\sum_{i=0}^{n} SFS_i}{n}$

Algorithm

Adaptive Frame-Selection

- $^{1}Frame - Similarity = \frac{2 \times F_i \times SF_i}{F_i{}^2 + SF_i{}^2 + a}$
- $^{2}\,Mean\ of\ window = \frac{\sum_{i=0}^{n} SFS_i}{n}$
- $n = 10$

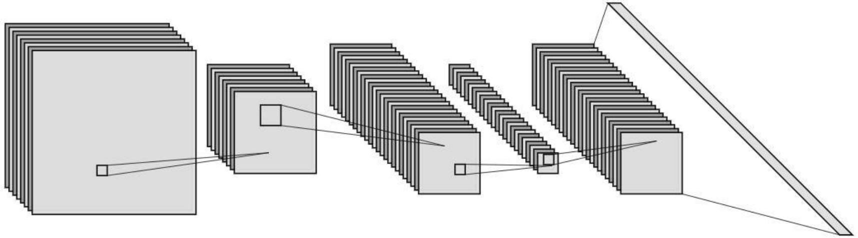
F = Frame
SF = Selected Frame
TR = Temp Result
AO = Algorithm output
S(TR) = scalar of Temp Result


Start
SF.append(First frame)
TR= mean of Algorithm $^1(F_0, F_1)$
AO= mean of Algorithm ^{1}(SF, F_i)
S(TR) = mean ^{2} (All TR)
is
S(TR) > AO
No
Yes
SF.append(F_i)
TR.append(AO)
End

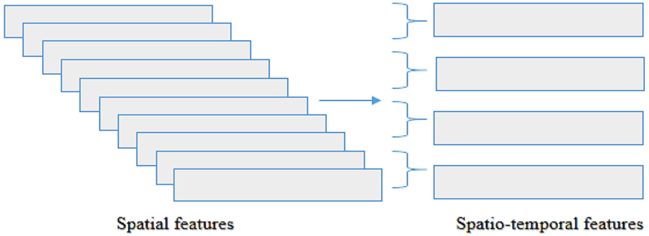
Feature Extraction

Spatio-Temporal pooling

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

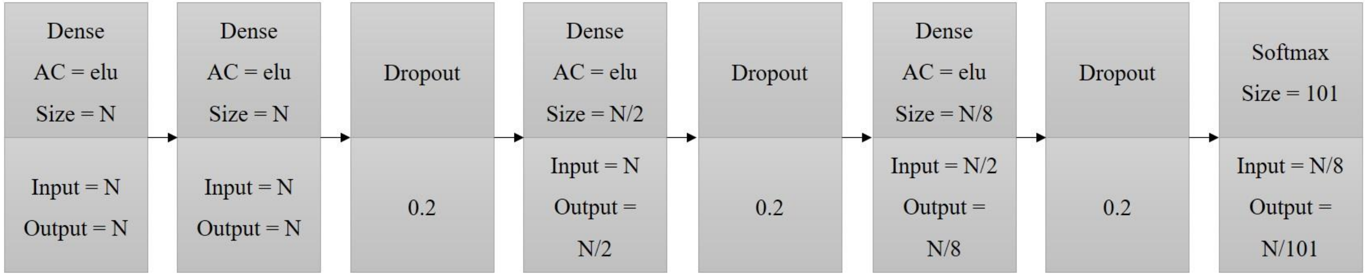


- Temporal pooling
  - Extract the maximum feature of the video
  - Data augmentation



Model

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

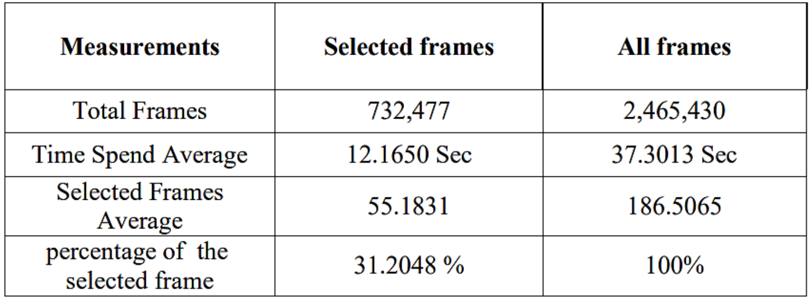


Dense AC = elu Size = N	Dense AC = elu Size = N	Dropout	Dense AC = elu Size = N/2	Dropout	Dense AC = elu Size = N/8	Dropout	Softmax Size = 101
Input = N Output = N	Input = N Output = N	0.2	Input = N Output = N/2	0.2	Input = N/2 Output = N/8	0.2	Input = N/8 Output = N/101

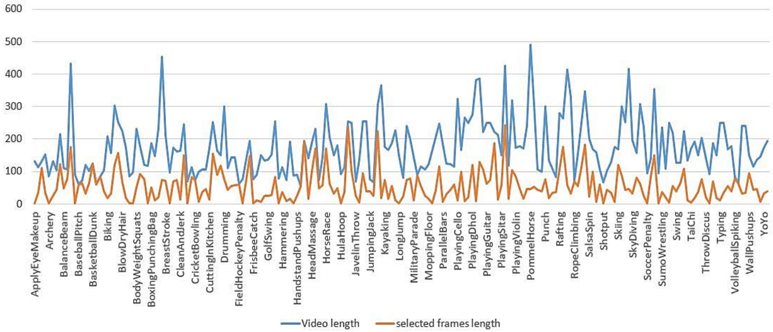
Results

Algorithm

COMPARISON OF TWO SCENARIOS: WITH OR WITHOUT FRAME SELECTION

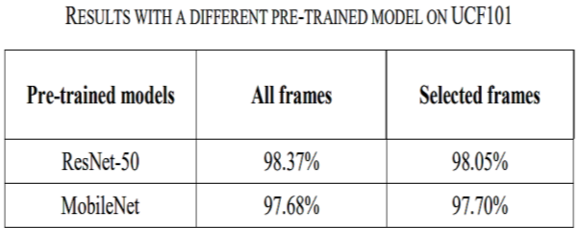


Measurements	**Selected frames**	**All frames**
Total Frames	732,477	2,465,430
Time Spend Average	12.1650 Sec	37.3013 Sec
Selected Frames Average	55.1831	186.5065
percentage of the selected frame	31.2048 %	100%



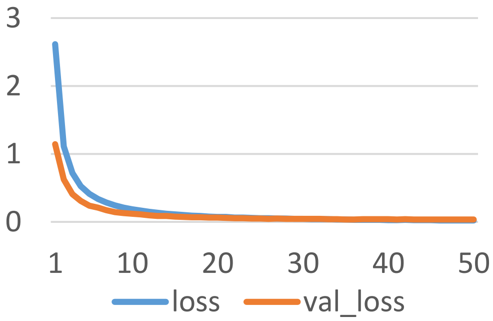
Results

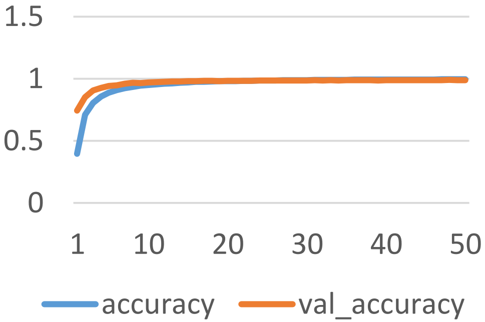
Train&Test



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%



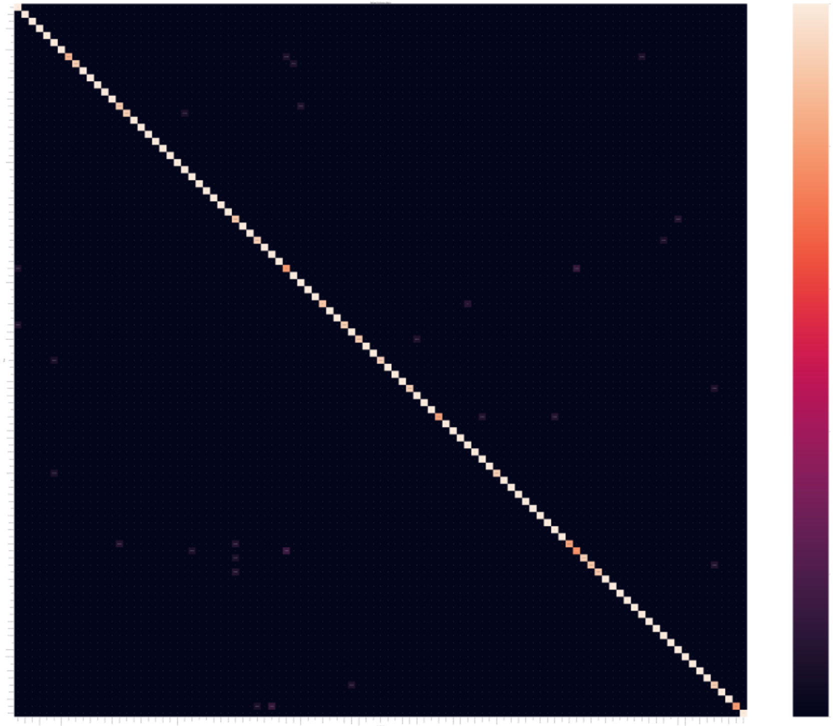


Conclusion and future work

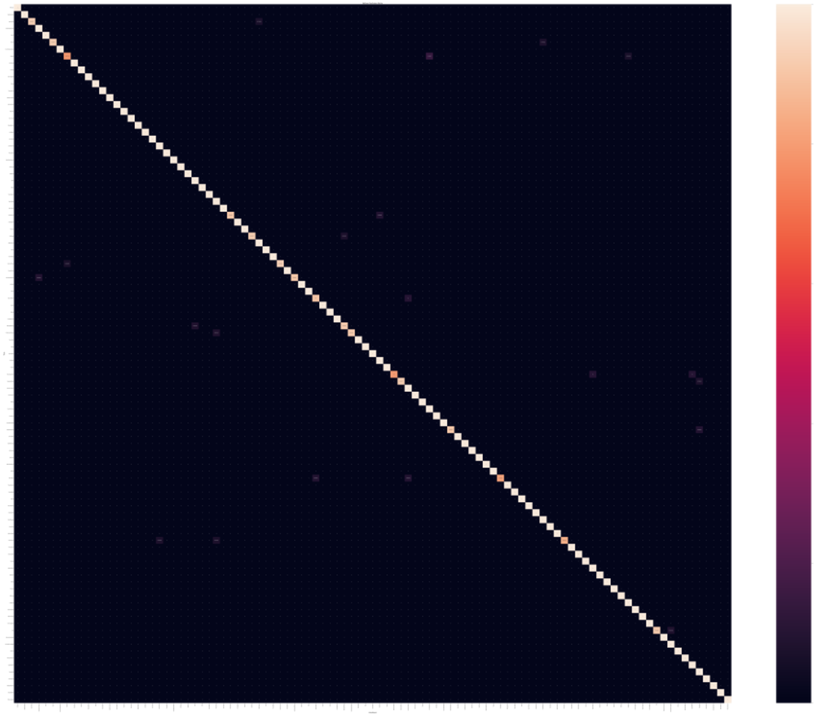
- Process in a shorter time
- Use data in compressed domain
  - Less process
  - Short time

Extra Result

Confusion Matrix



MobileNet



ResNet-50

Thanks for your attention

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