

Extreme Learning Machine for Large-Scale Action Recognition



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Outline



- Introduction
- Pipeline
- Feature extraction
- Extreme Learning Machine
- Experimental results

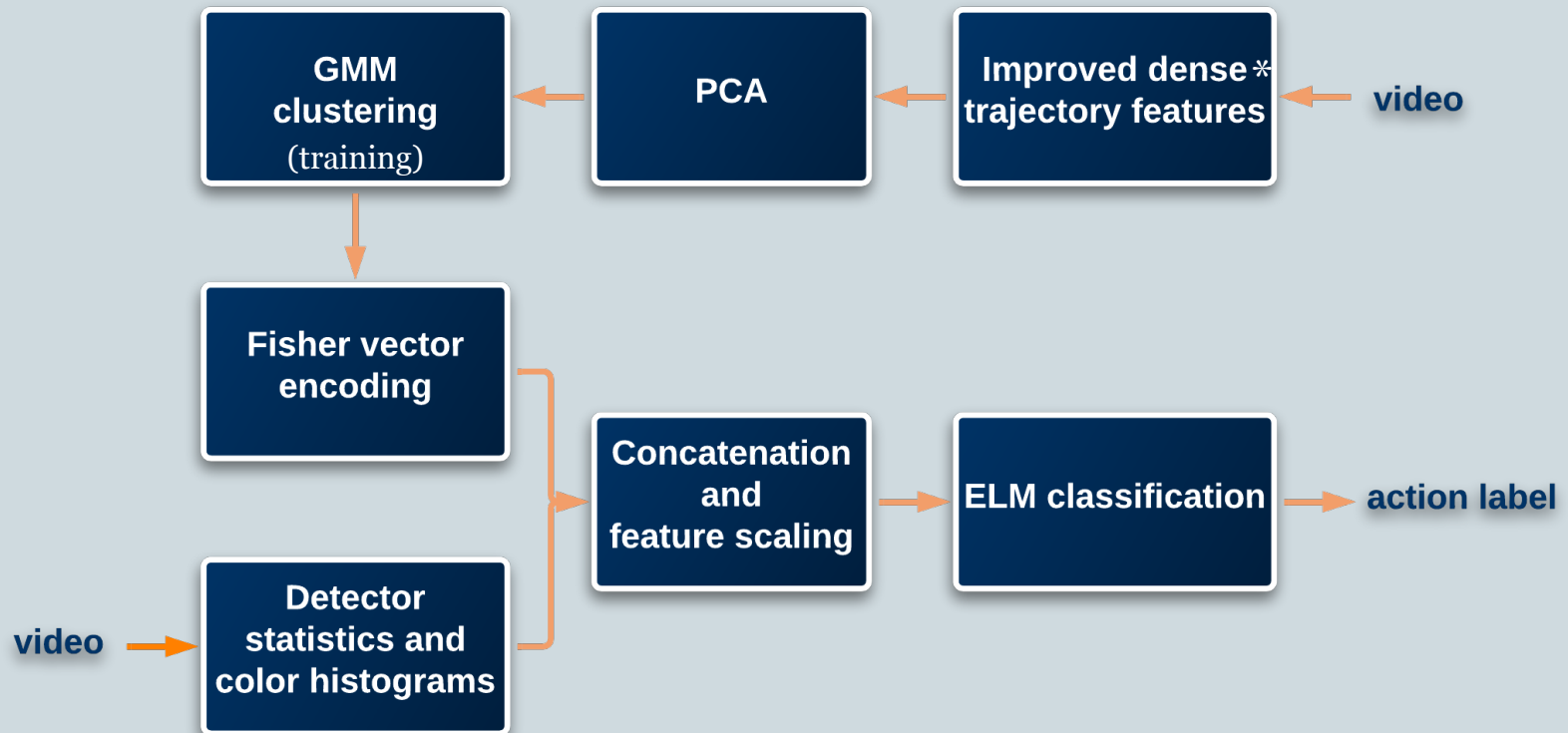
Introduction



- 101 action classes
- Temporally untrimmed videos
- 13320 training, 1010 validation, 1574 test videos



Pipeline



*Wang, H., Schmid, C.: Action recognition with improved trajectories. In: IEEE International Conference on Computer Vision. Sydney, Australia (2013)

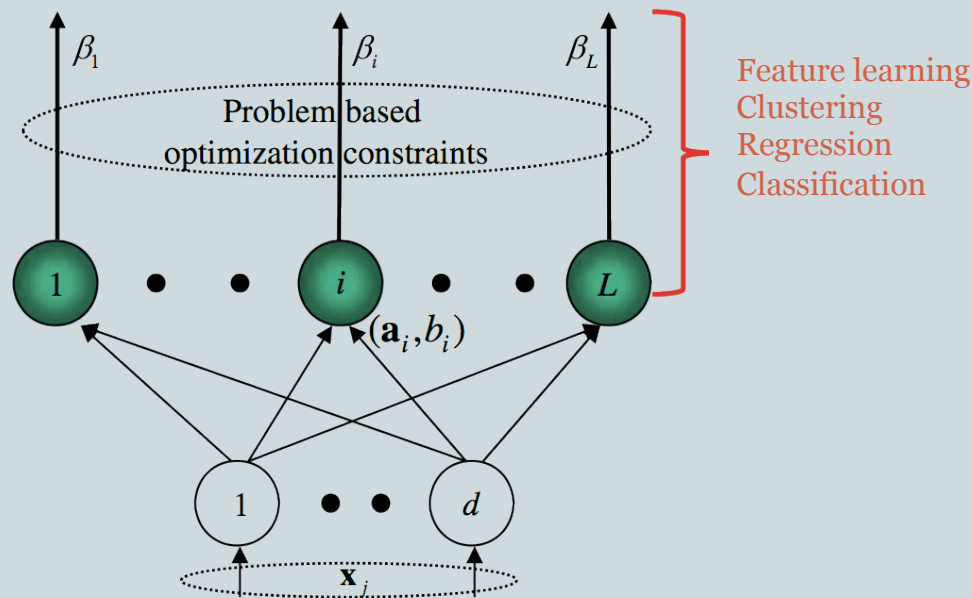
Feature Extraction



- Improved dense trajectory features
 - GMM clustering
 - Fisher vector encoding
- Mid-level features
 - Detector statistics
 - ✦ face, upper body, left eye, right eye, eye pair, profile, people
 - ✦ min, max, mean detection area
 - ✦ detection frequency
 - Color histograms
 - ✦ RGB
 - ✦ HSV

Extreme Learning Machine

- Extremely fast alternative to other conventional popular learning algorithms
- Works for generalized single-hidden-layer feed-forward networks
- No iterative tuning



Huang, G. B.: An insight into extreme learning machines: Random neurons, random features and kernels. Cognitive Computation 6(3), 376-390 (2014)

Experimental Results



Experimental Results



- Contributions of the individual aspects of the improved trajectory features

Feature set	mAP (%)
HOG	50.18
HOF	52.77
MBH	55.72
MBH + HOF	56.78
HOG + HOF	59.26
MBH + HOG	60.61
MBH + HOG + HOF	61.02

Experimental Results cont'd



- Bag of Features versus Fisher vector

Encoding	mAP (%)	Dimensionality
BOF	40.64	12000
FV	61.02	24576

Experimental Results cont'd



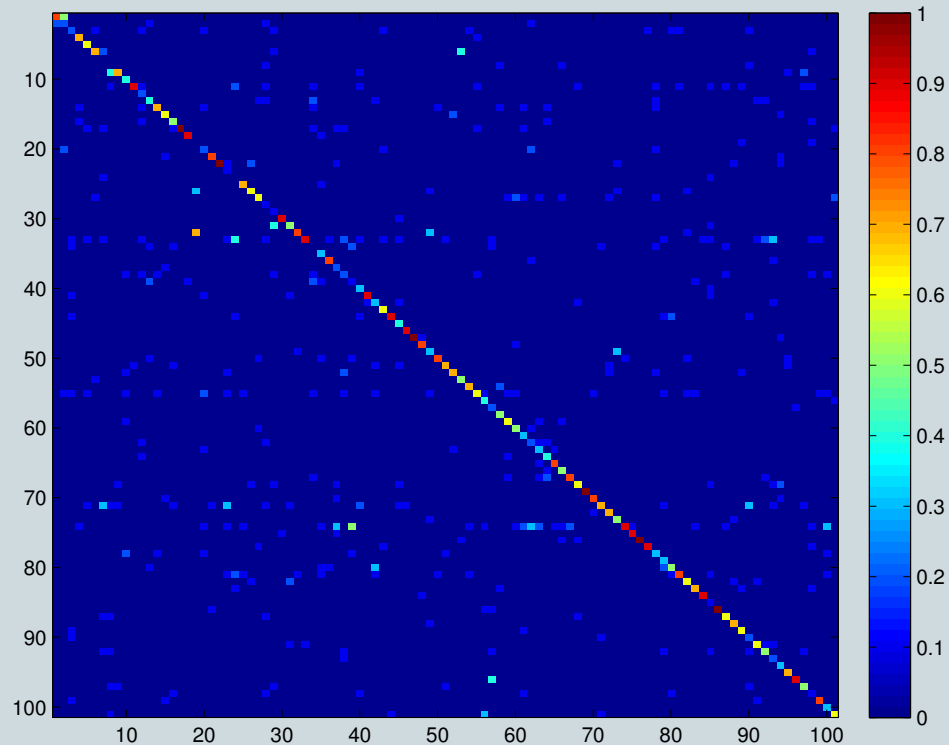
- Support Vector Machine versus Extreme Learning Machine

Algorithm	mAP (%)	Training time (sec)	Testing time (sec)
SVM	43.94	51920 (~14h)	885
ELM	62.27	92	11

Experimental Results cont'd



- Confusion matrix on the validation set



Two Most Confused Classes



- Breast stroke



- Front crawl



Test Set Results



Rank	Performance of the best run
1	71
2	67.2
3	63.16
4	62.01
5	56.75
6	51.61
7	48.2
8	38.56
9	29.55
10	29.19
11	0.77

Questions?

