Extreme Learning Machine for Large-Scale Action Recognition

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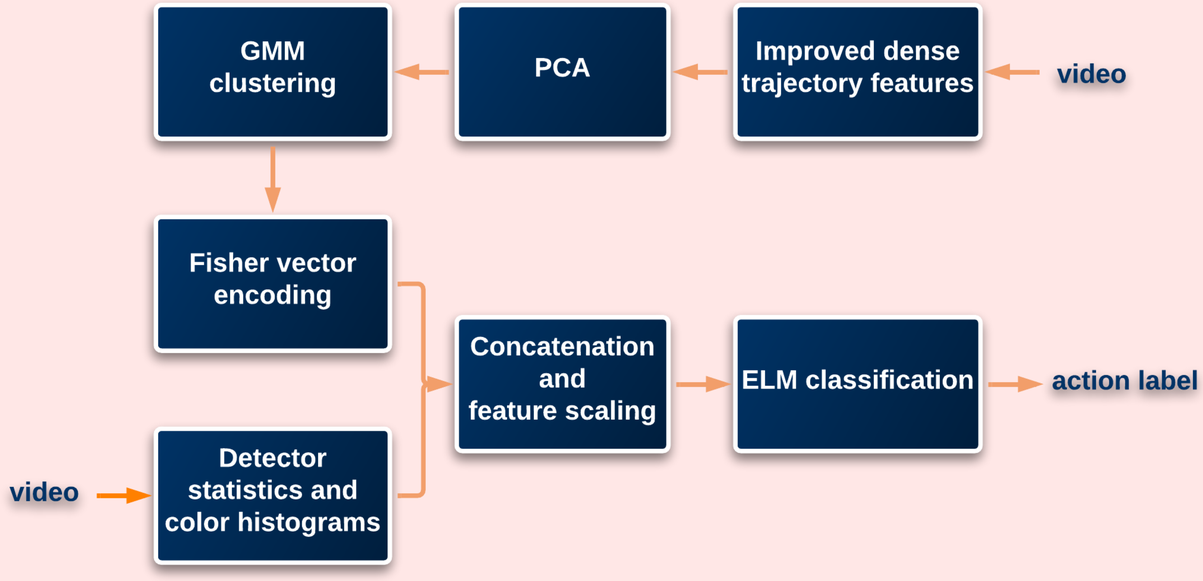
Overview

This work presents the method we applied for the action recognition task on the THUMOS 2014 challenge dataset. We study **human action recognition in RGB videos** through low-level features by focusing on **improved trajectory features** that are densely extracted from the spatio-temporal volume. We represent each video with **Fisher vector** encoding and additional mid-level features. Finally, we use **Extreme Learning Machines** for classification and achieve 62.27% mean average precision on the validation set.

[1]

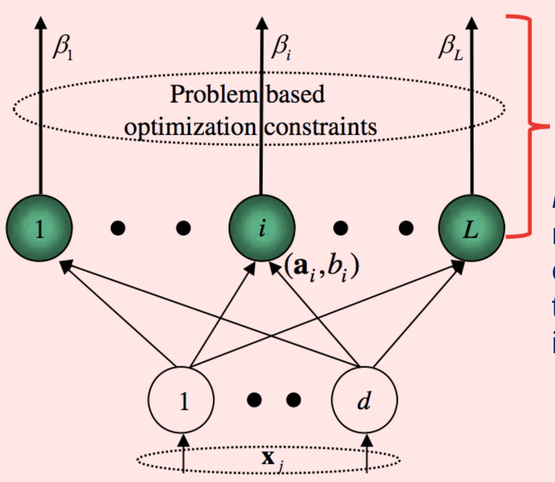
Feature Extraction

- Feature extraction, encoding and classification pipeline



Extreme Learning Machine

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



Feature learning
Clustering
Regression
Classification

L Random Hidden Neurons (which need not be algebraic sum based) or other ELM feature mappings. Different type of output functions could be used in different neurons:

$$h_i(x) = G_i(\boldsymbol{a}_i, b_i, \boldsymbol{x})$$

[2]

d Input Nodes

Experimental Results

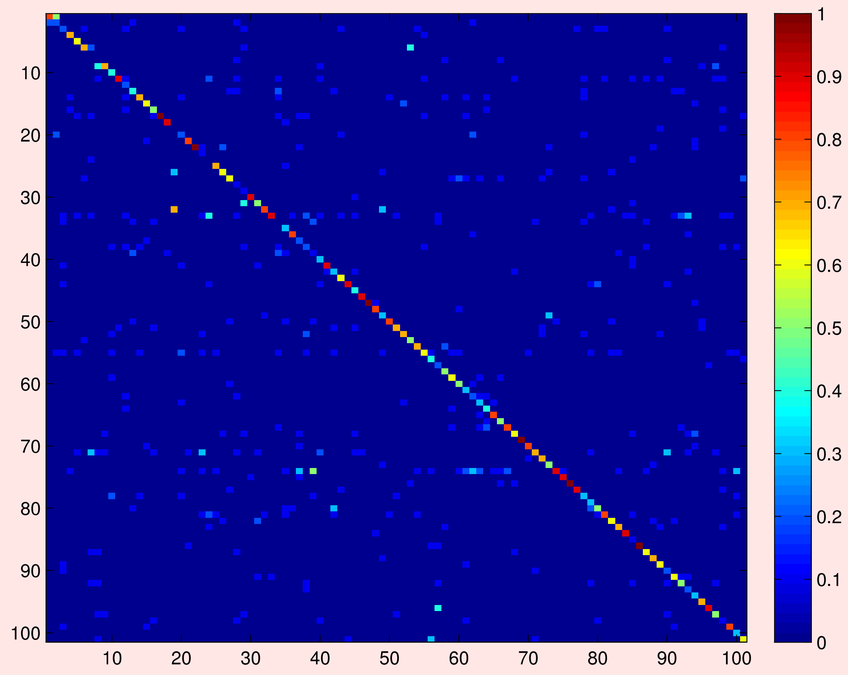
- Mean average precision values for various feature sets within improved dense trajectory features

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

- Bag of Features and Fisher Vector comparison for encoding MBH+HOG+HOF

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

- Confusion matrix on the validation set



- SVM and ELM comparison with the best feature combination (i.e. MBH+HOG+HOF+DS+RGBH+HSVH)

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

References

1. Jiang, Y.G., Liu, J., Roshan Zamir, A., Toderici, G., Laptev, I., Shah, M., Sukthankar, R.: THUMOS challenge: Action recognition with a large number of classes. http://crcv.ucf.edu/THUMOS14/ (2014)

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