INTRODUCTION

Action Attributes:
- Atomic components of action classes
  - motion patterns of human limbs and torso
- Contextual components of action classes
  - objects and scenes involved in the action
- Non-semantic attributes
  - data-driven attributes

Our Goal:
Detect action attributes and their temporal structure from sports videos

Example:
"At beginning, the athlete runs slowly while patting the ball for half a second; then he jumps forward while holding the ball for one second; then he jumps up and throws the ball (into the basket); after a touch down he fetches the ball and then runs slowly while patting the ball until the end of the video"

OLYMPIC SPORTS DATASET
- 16 actions
- 20 videos for each action (15 for training, 5 for testing)
- 24 attributes
  - 9 leg motion patterns
  - 6 arm motion patterns
  - 6 whole body motion patterns
  - 3 human-object interaction patterns

ALGORITHM

Low-level Feature Extraction:
- HoG and HoF extracted at STIPs within human bounding box
- All features are quantized into one of the 400 visual words

Elementary Attribute Detectors:
- SVM with $X^2$ kernel

Incorporating Contextual Constraints:
- Temporal contexts
- Semantic contexts

Factorial CRF Model (FCRF):

Learning Model Parameters

Objective function with L2 regularization

RESULTS

System Overview

Learning model parameters

action-attribute matrix

attribute semantic context

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