HMM

- Created an HMM with concepts as the hidden states and observations
- Used confusion matrix as observation probabilities
- Used Viterbi algorithm to correct for confusion among concepts
• Created an HMM with concepts as the hidden states and cluster centers as the observations

• Clustered SVM probabilities for each clip

• Trained the HMM using the causality matrix as the transition probabilities

• Used Viterbi algorithm to find the most probable sequence of states
Markov Chain Method

\[
\begin{bmatrix}
P_{1,1} \\
\vdots \\
P_{1,N}
\end{bmatrix} = \begin{bmatrix}
S_{1,1} \\
\vdots \\
S_{1,N}
\end{bmatrix}
\]

K: Clip number
N: Number of concepts
S: SVM probability
P: Updated probability
C: Causality

\[
\begin{bmatrix}
P_{K,1} \\
\vdots \\
P_{K,N}
\end{bmatrix} = \begin{bmatrix}
C_{1,1} & \cdots & C_{1,N} \\
\vdots & \ddots & \vdots \\
C_{N,1} & \cdots & C_{N,N}
\end{bmatrix}^T \begin{bmatrix}
P_{K-1,1} \\
\vdots \\
P_{K-1,N}
\end{bmatrix} \cdot \begin{bmatrix}
S_{K,1} \\
\vdots \\
S_{K,N}
\end{bmatrix}
\]
Markov Chain Method Accuracy

• Previously reported accuracy when limiting concepts to one clip as 60.51% with Markov approach compared to 51.92% using the max SVM probabilities

• Now accounting for concepts that span multiple clips and incorporating non-actions

• Calculating the probability of a non-action at each clip to be one minus the maximum SVM probability

• Accuracy only for clips that contain concepts
  • Markov: 70.40%
  • Max SVM: 59.51%

• Average of accuracies for each concept
  • Markov: 70.86%
  • Max SVM: 64.65%
Event Classification Methods

1. Trained an SVM on the max SVM probabilities of each concept in a clip
   • 11.81% accuracy

2. Used Markov approach to get sequence of clips, removed probabilities of clips containing no action, and trained SVM on max remaining probabilities
   • 15.37% accuracy

3. Trained on histogram of concepts for each clip after applying the Markov approach
   • 15.58% accuracy

4. Trained on histogram of concepts for each clip after applying the Markov approach and filtering out non-actions
   • 15.59% accuracy
Determining Non Actions Using Gaussian Fit

• Used a Gaussian fit function on the probability distribution of a single clip to find outliers

• Clips that do not have an outlying probability above at least two standard deviations are labeled as having no action
Current

• Getting better non-action recognition using outlier detection or other methods

• Using one vs. all event classifier

• Different feature representations other than histogram of concept occurrences or the vector of maximum SVM probabilities