WEEK 8 REPORT

Sports Video Summarization

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Determining Non-Actions

- Working on reliable way to predict non-actions that minimizes the amount of false negatives

- Determining non-actions is needed for creating the histogram of concepts used for event classification

- Current methods are not giving reliable results
  - Too many positives
  - Seemingly random choices for non-actions
  - Confusion in the SVM probabilities presenting a challenge
Methods for Determining Non-Actions

• Looking to determine if there is a single concept that has received a much higher probability than other concepts
  • We are considering this point as an outlier
  • If the SVM gives a high score to just one concept, using that as evidence that there is an action in that clip

• Statistical Methods
  • Concepts whose probabilities had a Z score greater than three would be labeled as non-actions
    • Returned nearly all positives (all actions)
    • Too many clips have high probabilities that are unrelated to actions
  • Another method uses the third quartile and the inner quartile range: $Q3+2.2*(Q3-Q1)$

• Confusion in the dataset is proving to be a challenge in determining the presence of an action
Co-occurrence and Frequency

• Co-occurrence is a symmetric version of our causality matrix
  • Looks on either side of a concept within a timespan
  • Computed by adding causality with its transpose

• Frequency gives the percentage that one concept occurred out of the number of all concepts that occurred in an entire event
Co-occurrence and Frequency

• Experimenting with adding co-occurrence and frequency to causality in our existing Markov based approach

\[
\begin{bmatrix}
Ca_{1,1} & \cdots & Ca_{N,1} \\
\vdots & \ddots & \vdots \\
Ca_{1,N} & \cdots & Ca_{N,N}
\end{bmatrix} \cdot \begin{bmatrix}
Co_{1,1} & \cdots & Co_{N,1} \\
\vdots & \ddots & \vdots \\
Co_{1,N} & \cdots & Co_{N,N}
\end{bmatrix} \cdot \begin{bmatrix}
P_1 \\
\vdots \\
P_N
\end{bmatrix} = \begin{bmatrix}
F_1 \\
\vdots \\
F_N
\end{bmatrix}
\]

• Results (using Bipartite Matching)
  • Only causality: 60.51%
  • With co-occurrence: 46.21%
  • With frequency: 60.05%
  • With co-occurrence and frequency: 56.71%
Our Method

Initialization

\[ P_1^1 = S_1^1 \]

Iteration

\[ P_K^1 = (P_{K-1}^1 C_{1,1} + P_{K-1}^2 C_{2,1} + \ldots + P_{K-1}^N C_{N,1}) \times S_K^1 \]

\[ K: \text{ Clip Number} \]

\[ N: \text{ Number of Concepts} \]

\[ S: \text{ SVM Probability} \]

\[ P: \text{ Updated Probability} \]

\[ C: \text{ Causality Probability} \]
Our Method - Example

SVM Probabilities

Our Method’s Probabilities
Our Method – Example

SVM Probabilities

Our Method’s Probabilities
Results

Using Max SVM

Our Method

77.95% Accuracy

81.06% Accuracy
Currently

• Getting event classification accuracies using updated annotation

• Improving non-action detection

• Finding better ways of combining causality, co-occurrence, and frequency