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

$$\begin{bmatrix} Ca_{1,1} & \dots & Ca_{N,1} \\ \vdots & \ddots & \vdots \\ Ca_{1,N} & \dots & Ca_{N,N} \end{bmatrix} .* \begin{bmatrix} Co_{1,1} & \dots & Co_{N,1} \\ \vdots & \ddots & \vdots \\ Co_{1,N} & \dots & Co_{N,N} \end{bmatrix} * \begin{bmatrix} P_1 \\ \vdots \\ P_N \end{bmatrix} .* \begin{bmatrix} F_1 \\ \vdots \\ F_N \end{bmatrix}$$

- 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

K: Clip Number
N: Number of Concepts
S: SVM Probability
P: Updated Probability
C: Causality Probability

Initialization

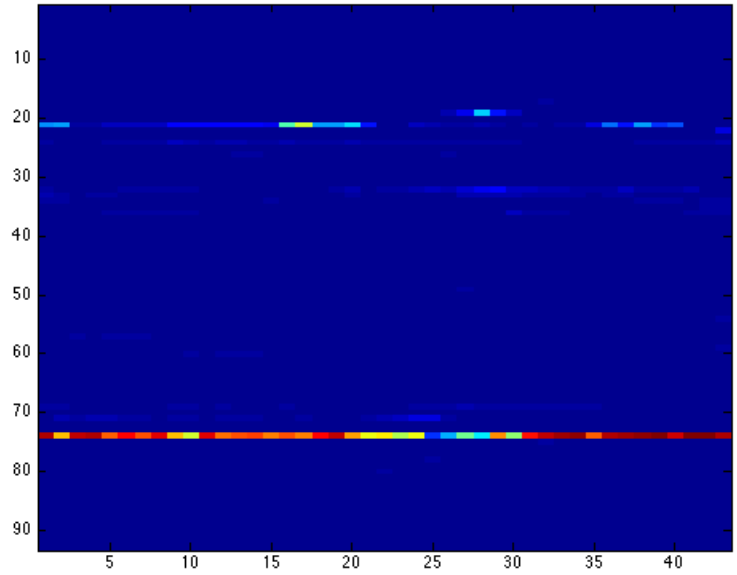
$$P_1^1 = S_1^1$$

Iteration

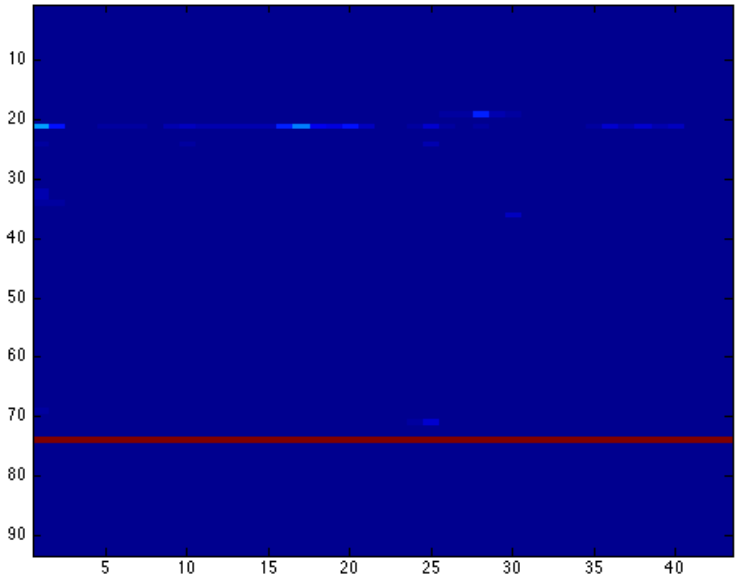
$$P_K^1 = (P_{K-1}^1 C_{1,1} + P_{K-1}^2 C_{2,1} + \ldots + P_{K-1}^N C_{N,1}) * S_K^1$$

Our Method - Example

SVM Probabilities

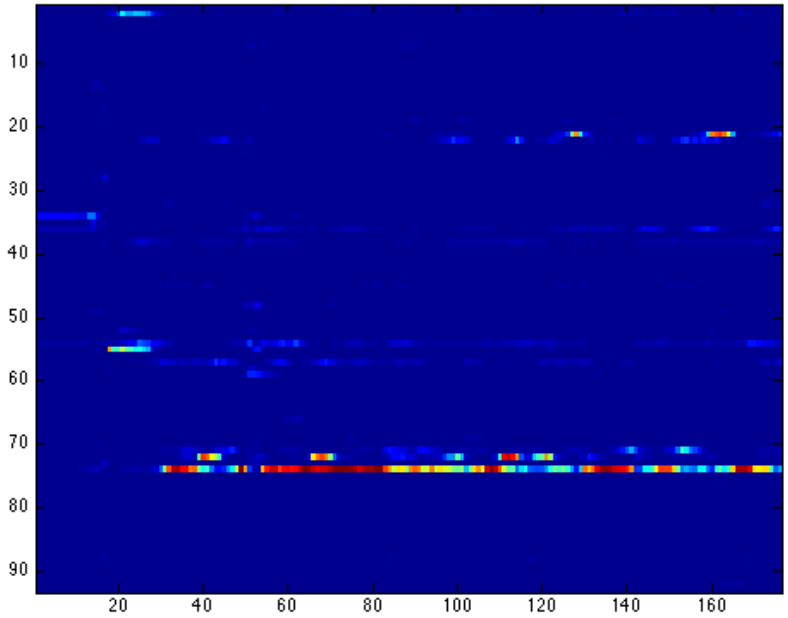


Our Method's Probabilities

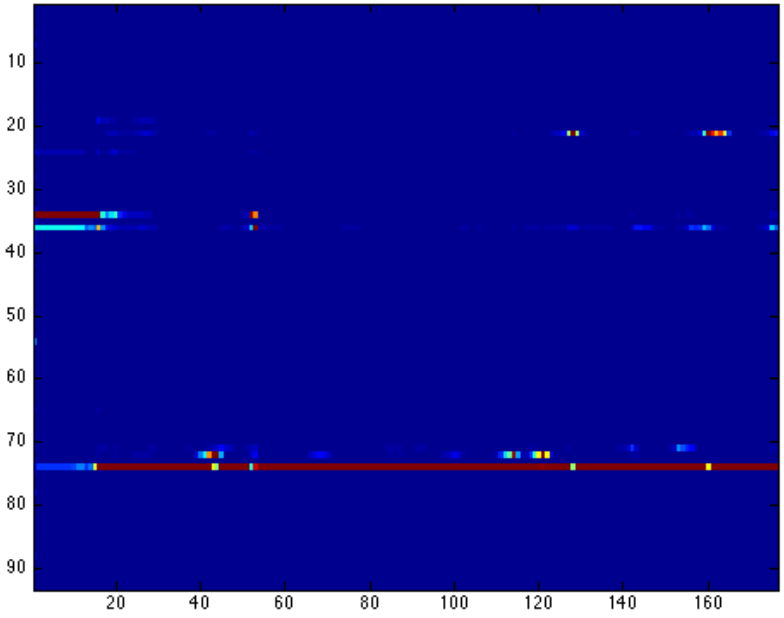


Our Method – Example

SVM Probabilities

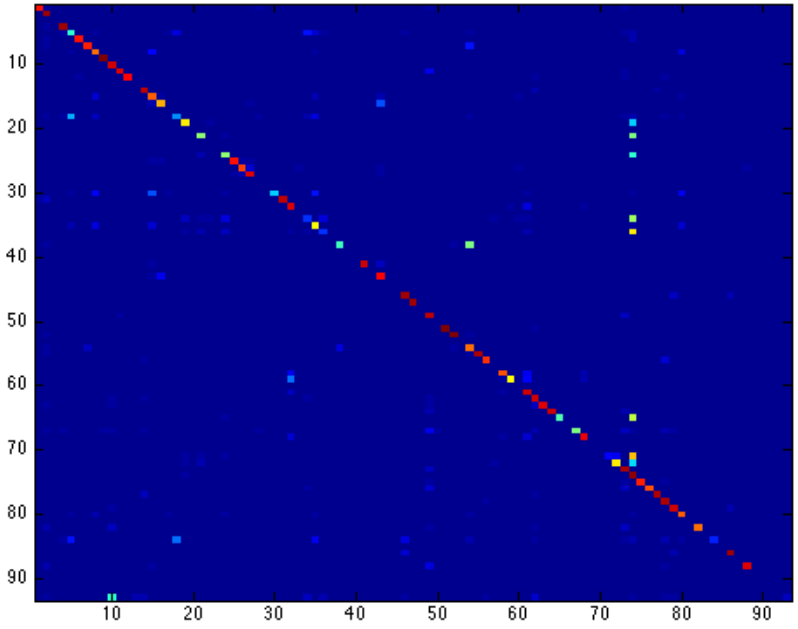


Our Method's Probabilities



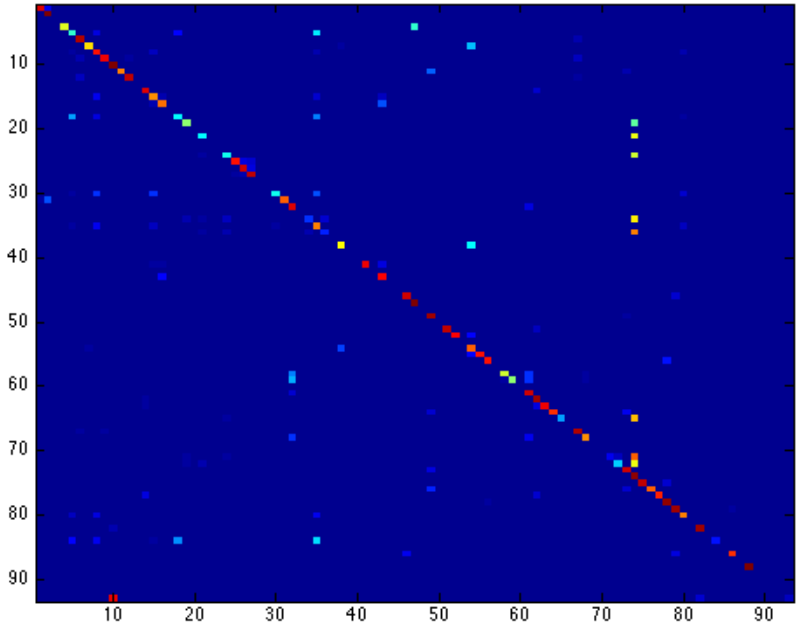
Results

Using Max SVM



77.95% Accuracy

Our Method



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