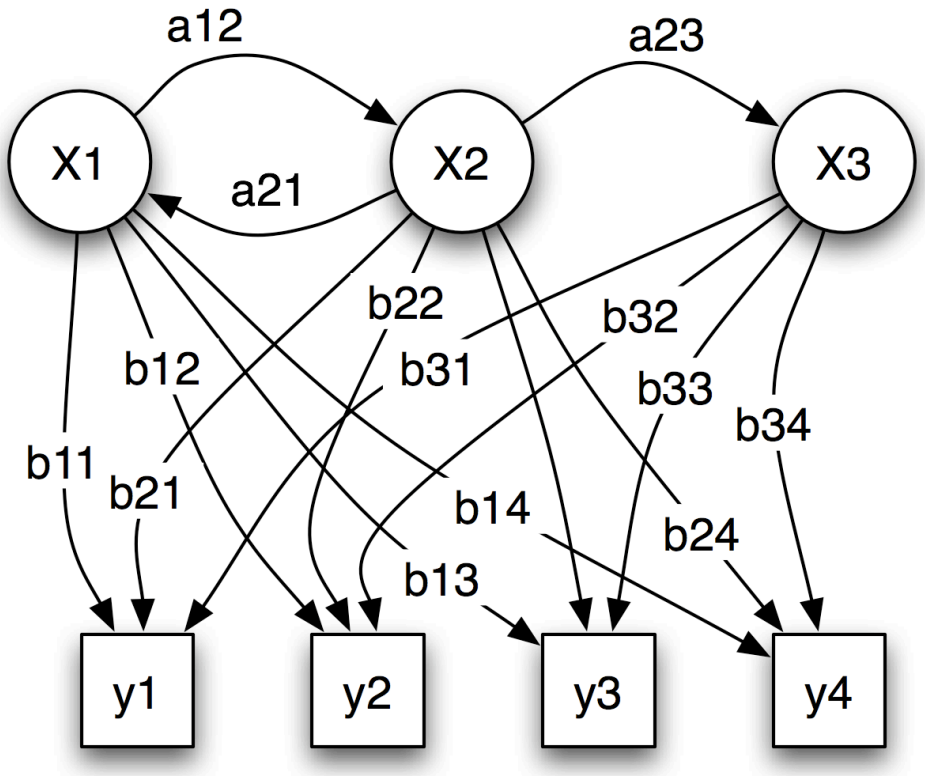
# WEEK 7 REPORT

## Sports Video Summarization

Khurram Soomro
Christian Weigandt
Levi Smith

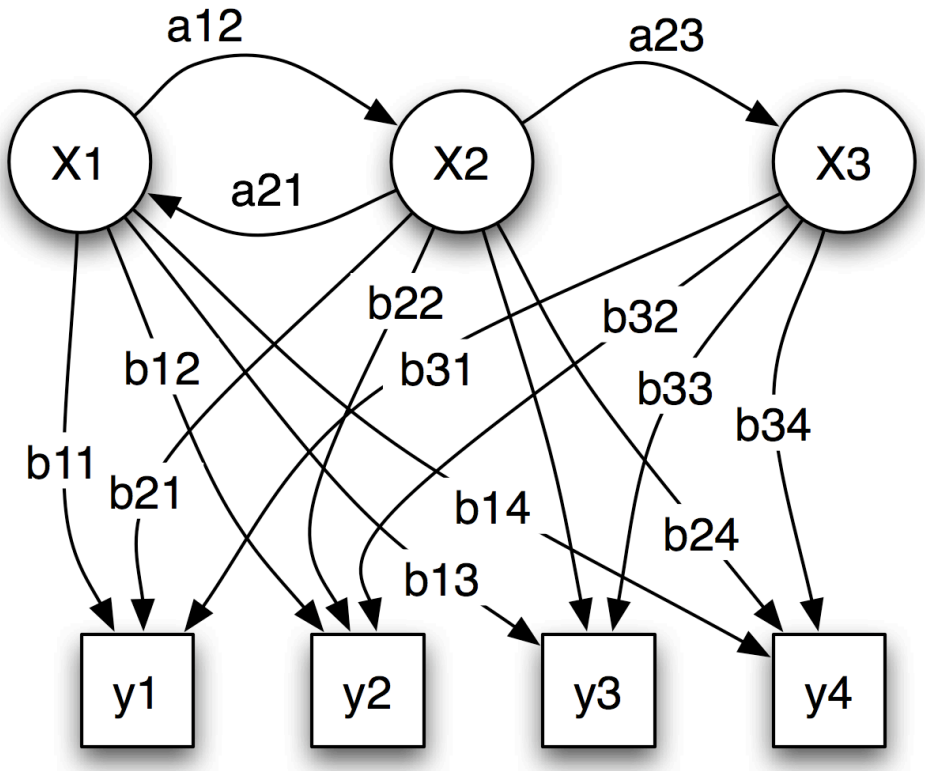
# HMM

- 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



# HMM

- 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

$$\begin{bmatrix} P_{K,1} \\ \vdots \\ P_{K,N} \end{bmatrix} = \begin{bmatrix} C_{1,1} & \cdots & C_{1,N} \\ \vdots & \ddots & \vdots \\ C_{N,1} & \cdots & C_{N,N} \end{bmatrix}^T \begin{bmatrix} P_{K-1,1} \\ \vdots \\ P_{K-1,N} \end{bmatrix} .* \begin{bmatrix} S_{K,1} \\ \vdots \\ S_{K,N} \end{bmatrix}$$

# 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

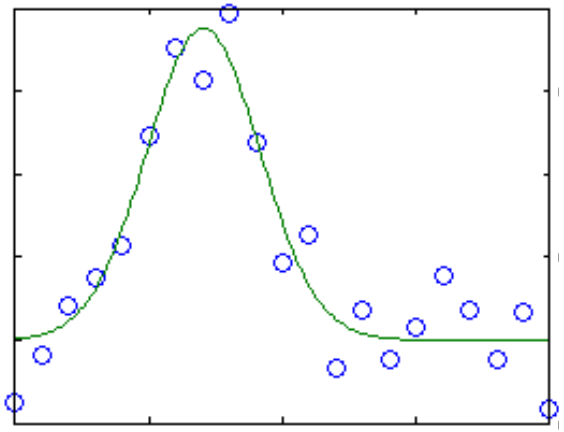
- Using 5-fold cross-validation over 14 events

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