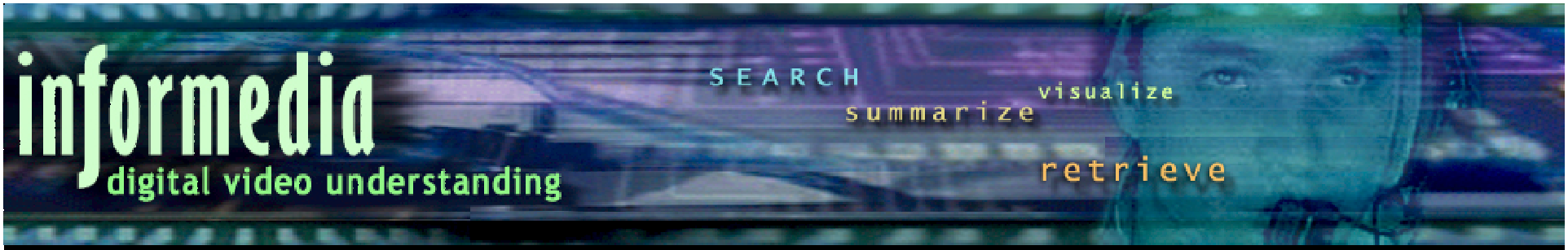


Learning Weights in Manual Video Retrieval

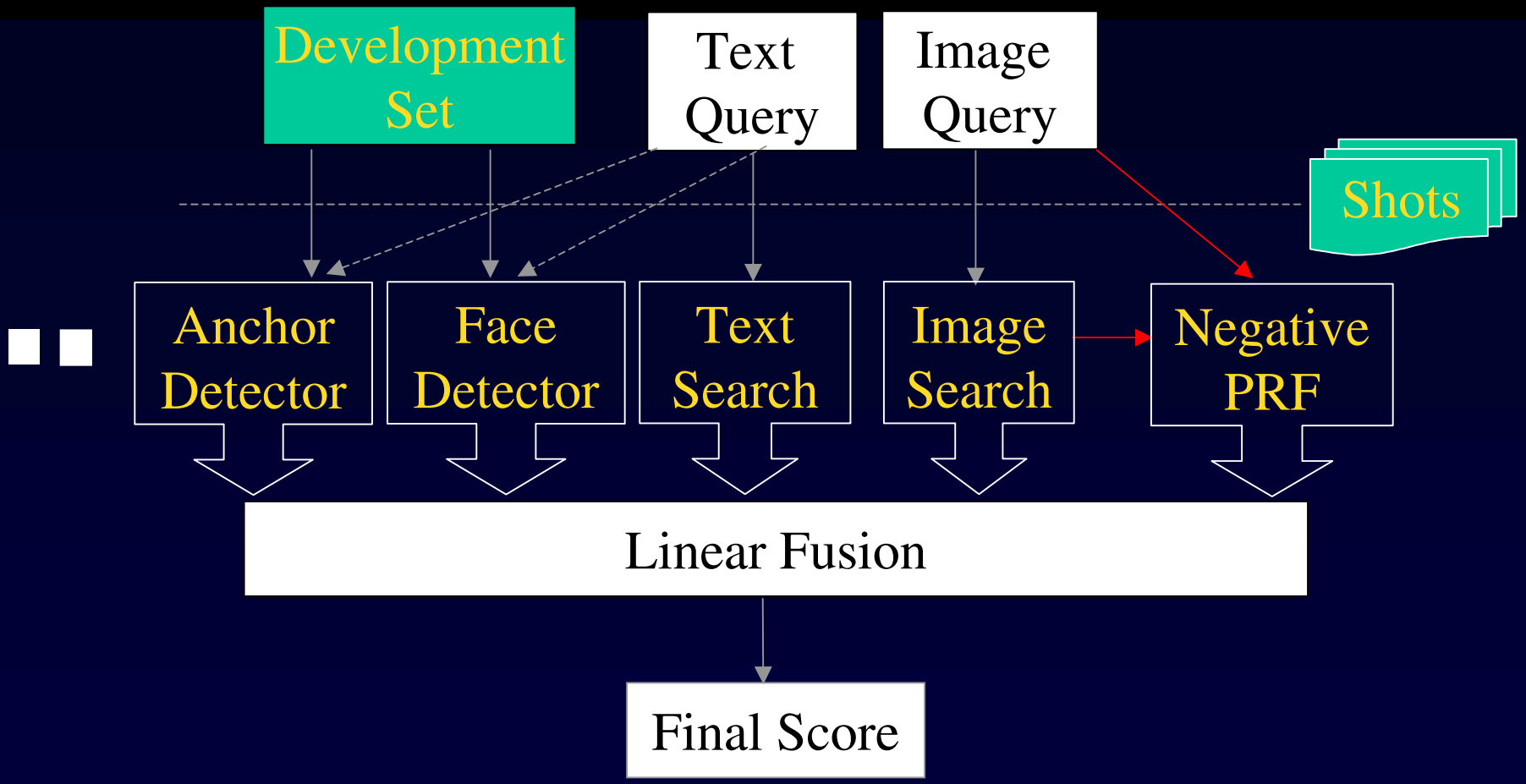
Nov.18

Rong Yan
Carnegie Mellon University

Outline

- Framework and features
- Learning weights
- Experimental results
- Conclusion

Framework


Development Set
Text Query
Image Query
Shots
Anchor Detector
Face Detector
Text Search
Image Search
Negative PRF
Linear Fusion
Final Score

Features

- Text features
  - Automatic speech transcripts (ASR): sphinx, LIMSI
  - Video optical character recognition (VOCR)
  - Closed caption (CC)
- Image features
  - HSV color histogram: 150 bins
  - Gabor wavelet histogram: 108 bins
  - Canny edge histogram: 72 bins
- Face features
  - Presence of face

Modified Version of NPRF

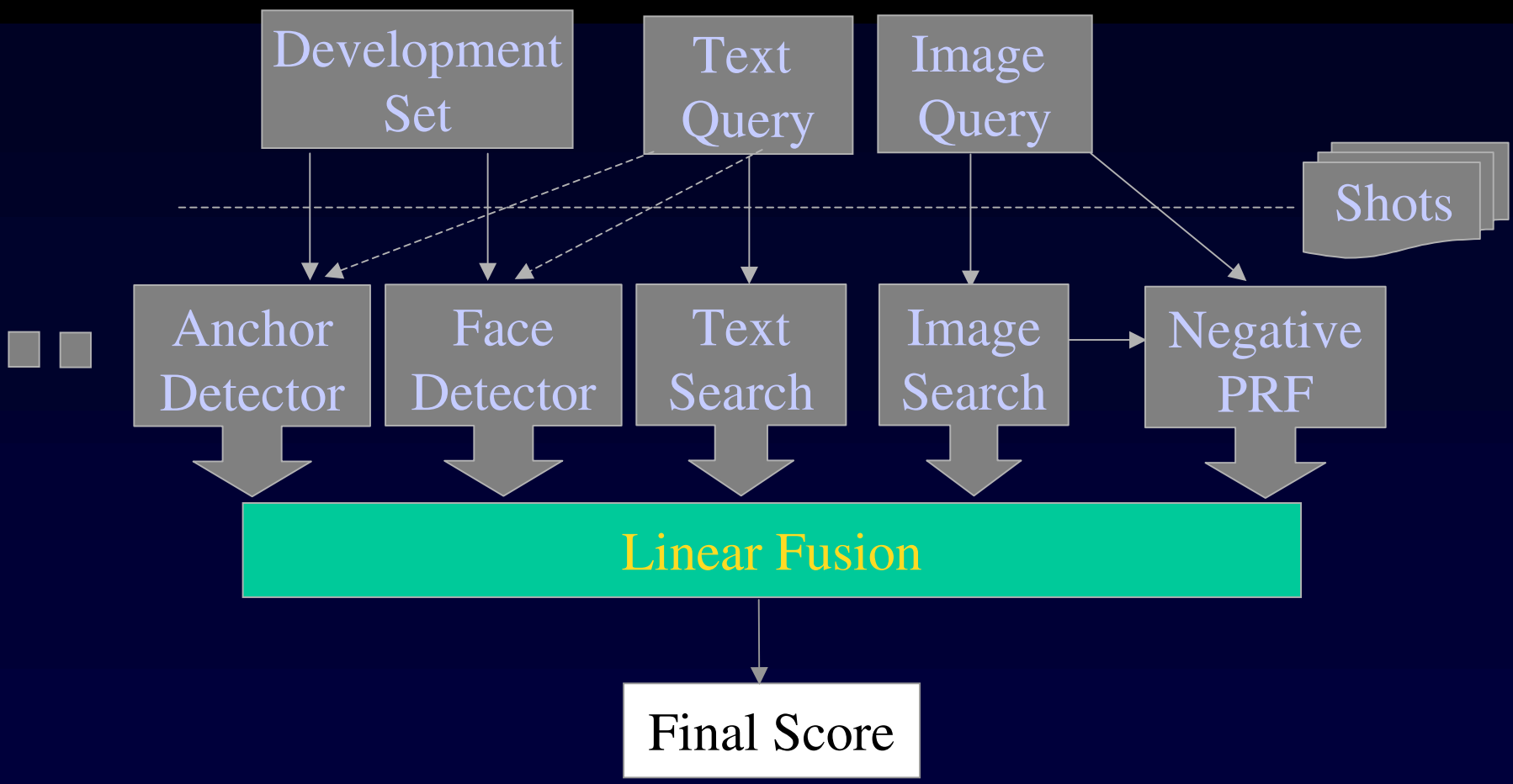
- Negative pseudo-relevance feedback (NPRF)
  - Images farthest from query examples as the negative images
  - A support vector machine is learned to provide retrieval scores
- Modified sampling strategies
  - Negative samples should be dissimilar to each other
  - Maximal marginal irrelevance (MMIR) criterion
    - "Irrelevance" + "novelty"

$$MMIR = arg \min_{D_i \in T \setminus S} \left[\lambda Sim_1(D_i, Q) + (1 - \lambda) \max_{D_j \in S} Sim_2(D_i, D_j) \right]$$

Other semantic features

- Anchor detector
- Commercial detector
- Face recognition (in Person X queries)

Fusion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Linear Fusion

- Weighted Borda fuse model
  - Generate rank lists from different features
  - Normalize output scores into rank-based scores
  - Linear combination $y = \sum_{i=1}^{n} w_i s_i$
- Our focus
  - How to estimate the linear weights w_i

Learned by query types

- Prior information
  - *Finding Persons: (text 2, face 1, color 1, anchor 0)*.
  - Aircraft and animals: *(text 2, face -1, edge 1, anchor -1)*
  - Others: *(text 2, face -1, color 1, anchor –1*)

Learned by development set

- Supervised learning
  - Collect truth video shots in the development set using the Informedia clients in 15 minutes
  - Learning the weights using standard classifiers

Co-Retrieval

- Text retrieval results as feedback to learn weights
  - Inspired by multi-modal learning or co-training
- Algorithms
  - Grouping: Break the feature sets into two groups.
    - Text features vs. the other features;
  - Labeling: Label top K pseudo-positive data based on text
  - Learning: Use the pseudo-positive data to learn the linear weights
  - Score combination: Combine the scores with the learned weights.

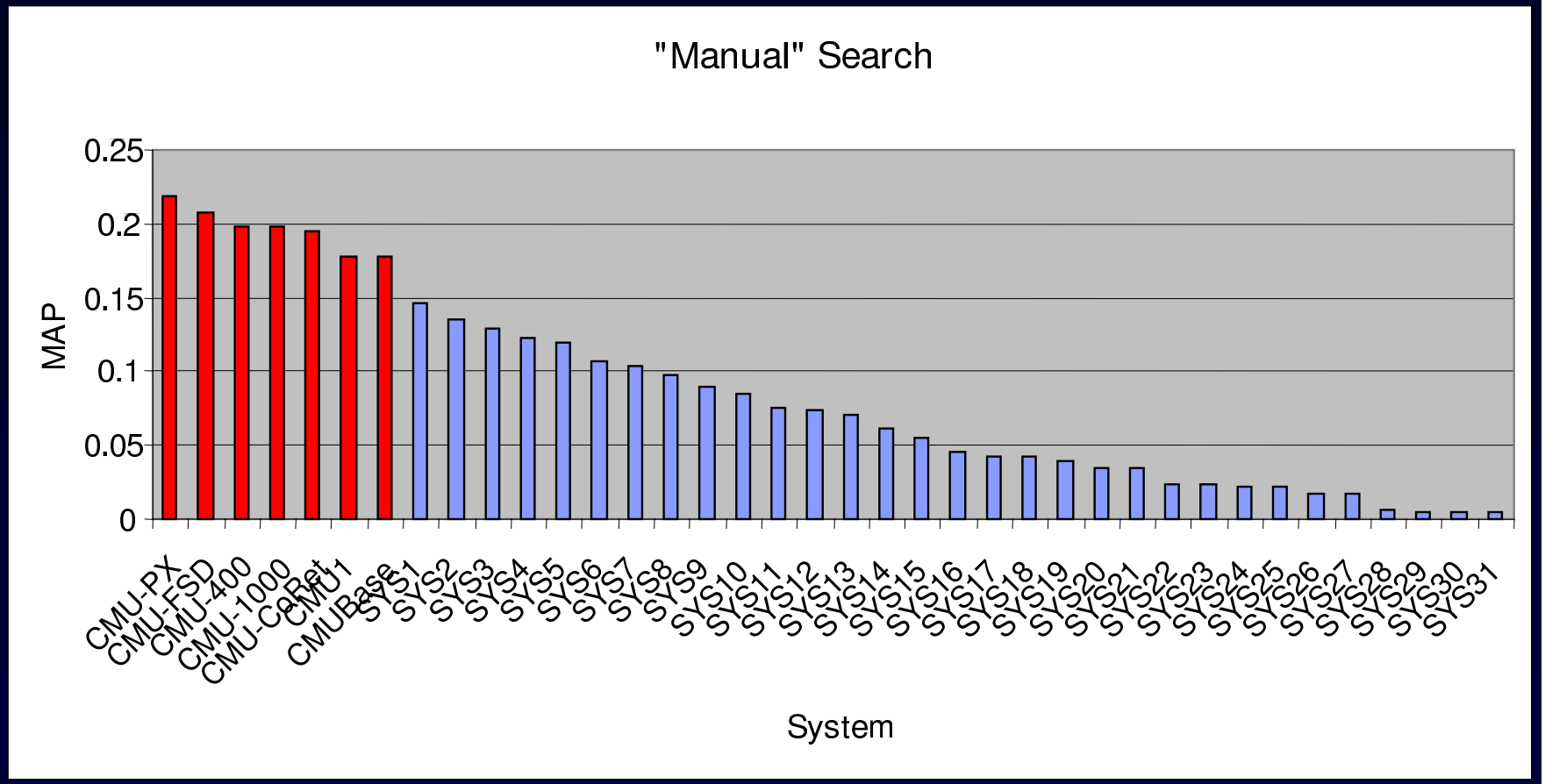
Descriptions of each run

- CMU-PX:FSD + Face recognition
- CMU-FSD: Tuned linear weighting with FSD truth
- CMU-400: Weighting from query types
- CMU-1000: Tuned linear weighting with FSD truth
- CMU-CoRet: CoRetrieval using top 100 shots as truth
- CMU1: as CMU-400 with 200 shots only
- CMUBase: text retrieval [ASR, CC + OCR]
- CMUBase1: text retrieval [ASR, CC]

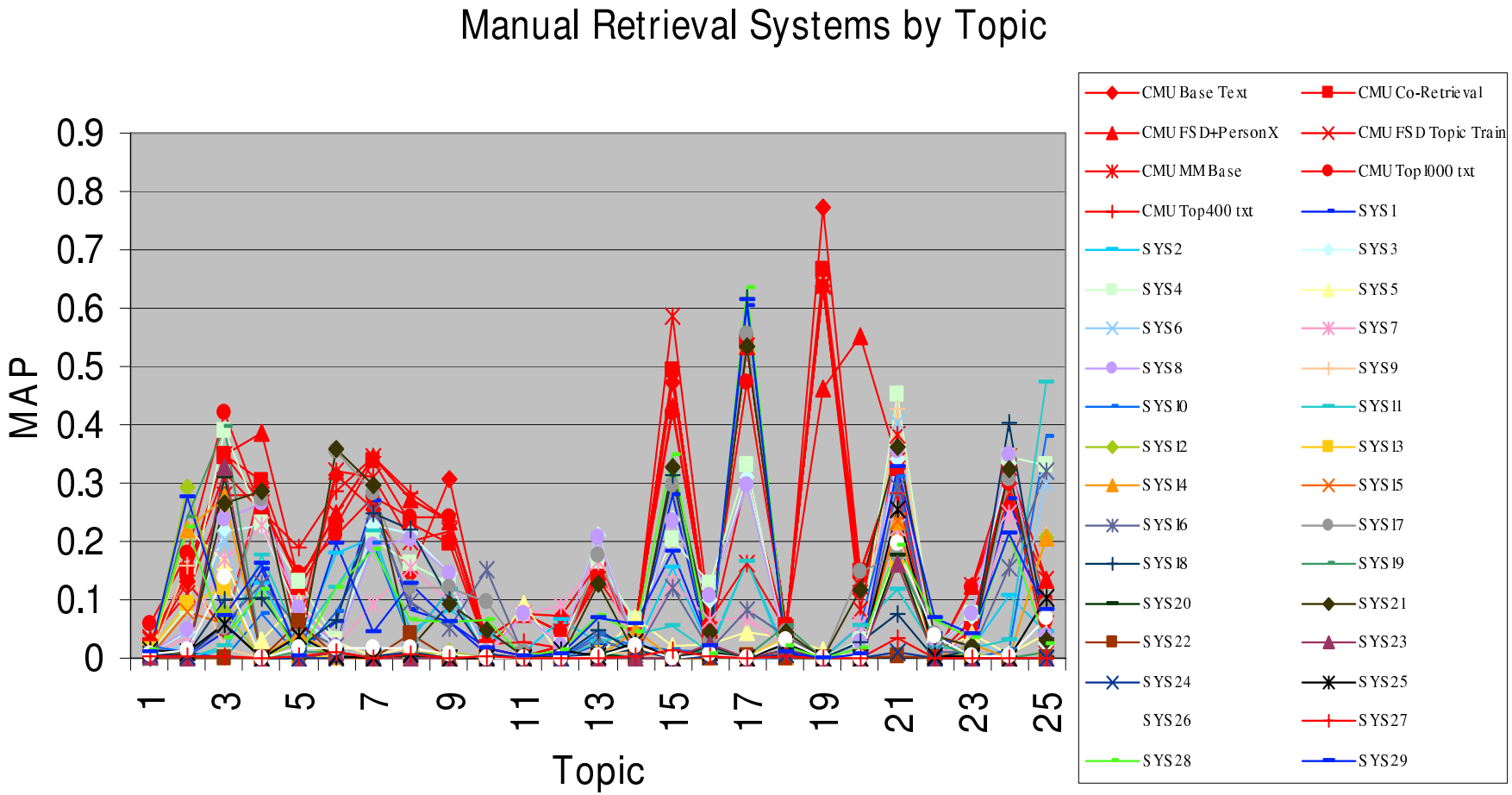
MAP Performance

Runs	MAP
CMU-PX	0.218
CMU-FSD	0.207
CMU-400	0.198
CMU-1000	0.198
CMU-CoRet	0.195
CMU1	0.178
CMUBase	0.177
CMUBase1	0.155

Overall MAP for Manual Systems



Results by Topics



Conclusion

Estimate parameters

- Problem: How to estimate the parameters A & B
  - Manual Setting
  - Use rank-based score to approximate
    - Known as “Weighted Borda Fuse” in Meta-Search

$$p(+|t = t_0) = Pr(t_0 < t < \infty)$$
$$= 1 - D(t_0) = 1 - \frac{Rank(e)}{N}$$