

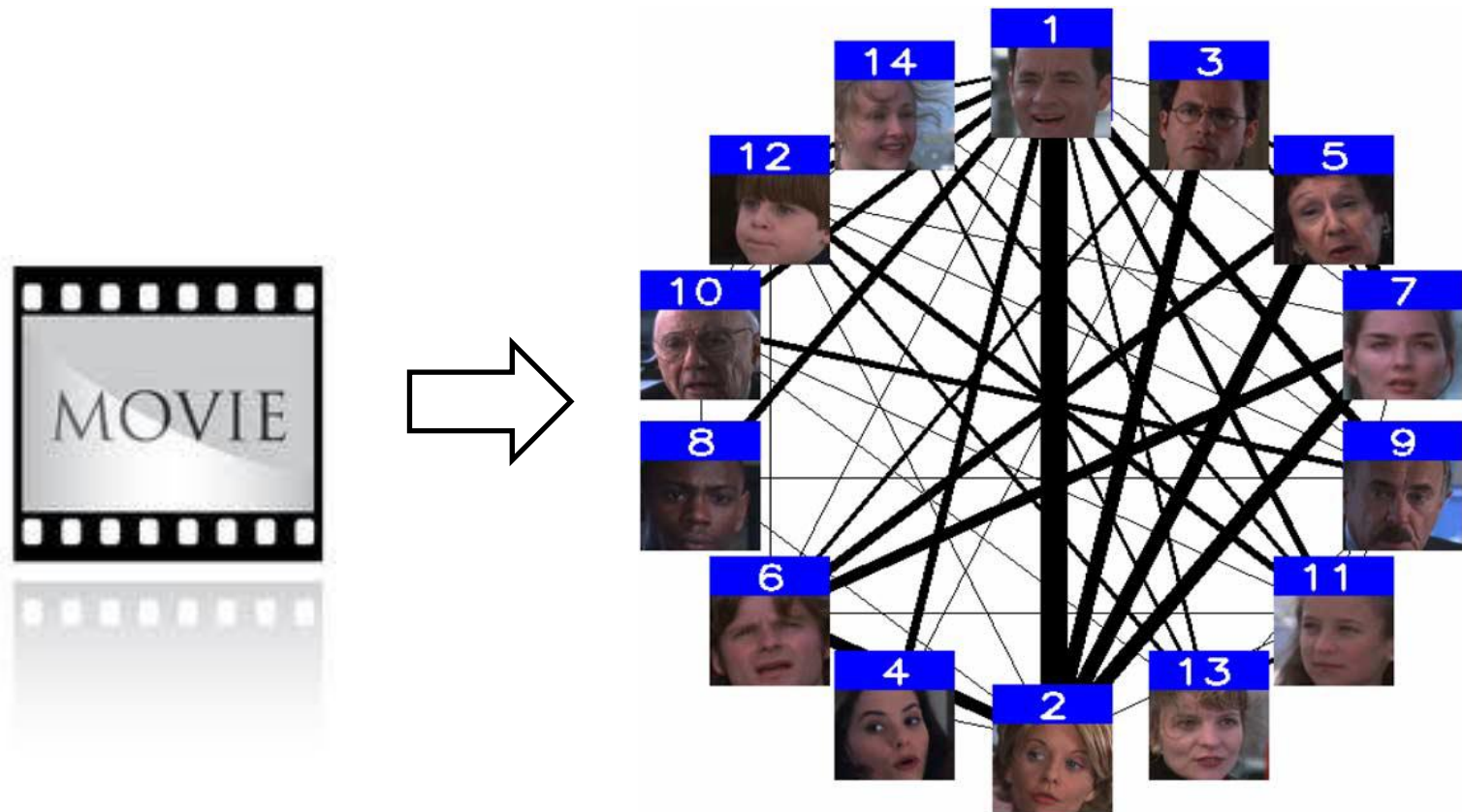


AUTOMATIC SOCIAL NETWORK CONSTRUCTION FROM MOVIES USING FILM-EDITING CUES

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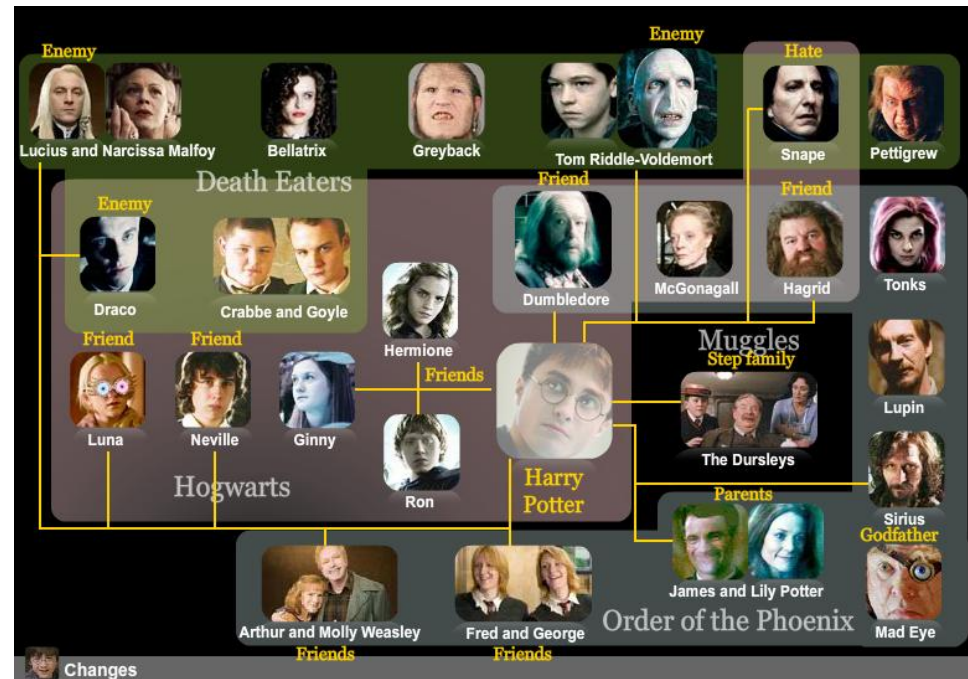
CHARACTERS' SOCIAL NETWORK



C. -Y. Weng, W.-T. Chu, and J. -L. Wu, "RoleNet: Movie Analysis from the Perspective of Social Network," *IEEE Trans. on Multimedia*, vol. 11, no.2, pp.256-271, February, 2009.

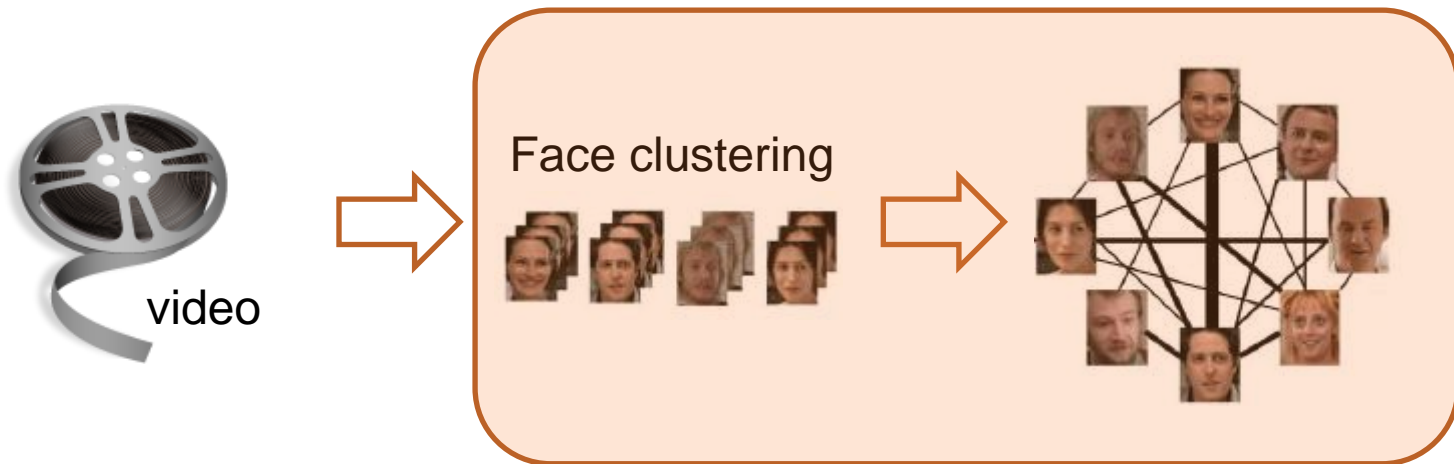
USES OF SOCIAL NETWORKS

- Story segmentation
[Vinciarelli and Favre, *MM* 2007]
[Weng et al., *TMM* 2009]
- Face annotation
[Stone et al., *Internet Vision* 2008]
[Plantie and Crampes, *MM* 2010]
[Wu and Tang, *MM* 2010]
- Community discovery
[Yuan et al., *ICASSP* 2010]
- ...



CONSTRUCTION OF SOCIAL NETWORKS

- Require minimal human intervention
- A general framework



Y. -F. Zhang, C. Xu, H. Lu, and Y. -M. Huang, "Character Identification in Feature-Length Films Using Global Face-Name Matching," *IEEE Trans. on Multimedia*, vol.11, no. 7, Nov. 2009.



EXISTING APPROACHES

- Utilize **co-appearance** to quantify characters' relationship [Weng et al. 2009, Wu and Tretter, 2009, Yuan et al. 2010, Plantie and Crampes, 2010]
 - No. of scenes where two characters both appear



Interaction matters!



OUR APPROACH

- Quantifies characters' relationships by their interactions!
- Fully automatic, requires no human labeling
- Simple



OUTLINE

- Introduction
- Approach
 - Film-editing guidelines
 - Forming face clusters
 - Constructing characters' social network
- Experimental results
- Conclusion and future work

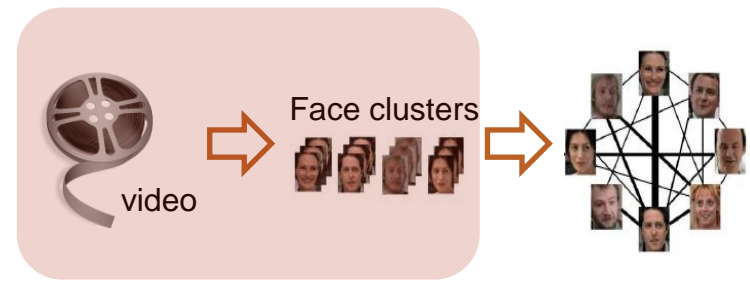


FILM-EDITING GUIDELINES

- **180° rule:** a character will consistently appear on the left (or right) side of the screen through a scene
- **Shot alternation rule:** two consecutive shots usually show a different character



FACE CLUSTERS

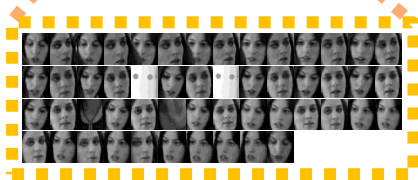


1. Shot change detection



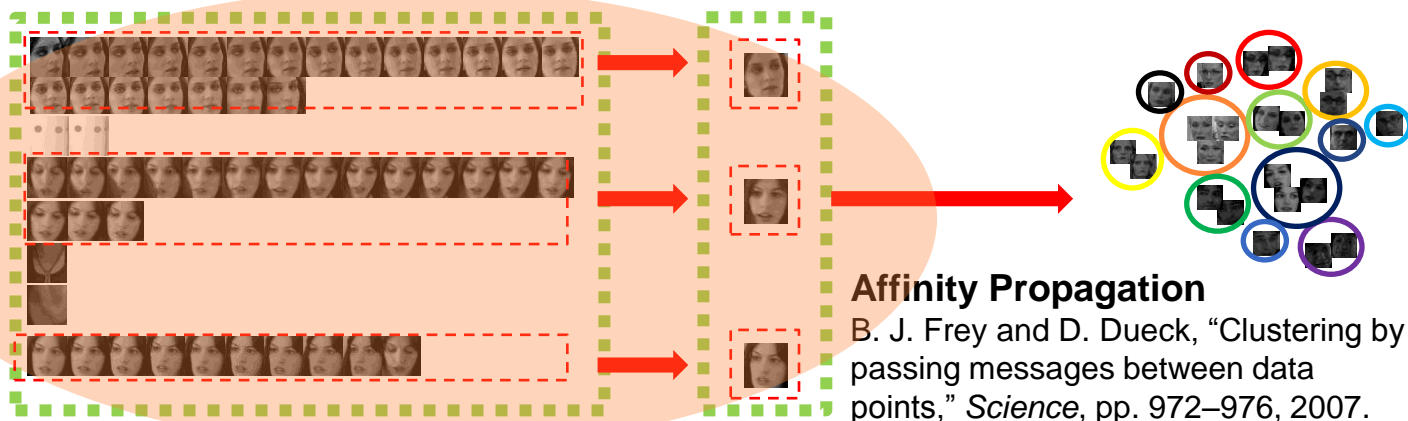
Intensity histograms
Bhattacharyya Coefficients

2. Face detection and description



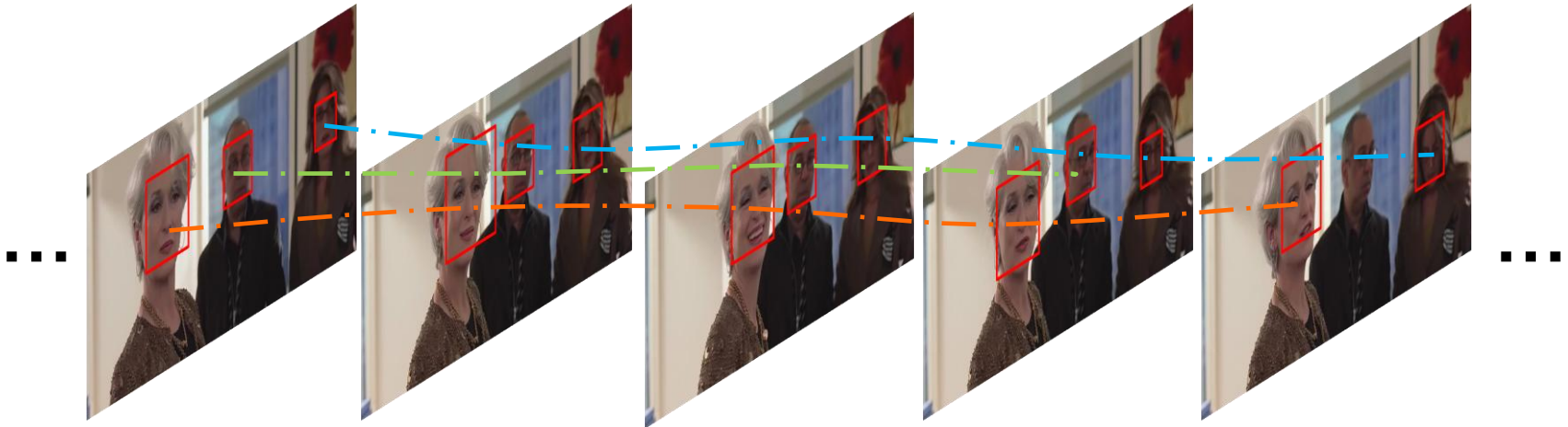
Local Binary Patterns (59-dim)
Chi-squared distances

3. Forming face tracks and face clusters



FORMING FACE TRACKS

180° rule: a character will consistently appear on the left (or right) side of the screen through a scene



Location and scale constraints:

1. Face displacement $L_2(c_i, c_{i-1}) \leq s_{i-1}$
2. Face scale $L_1(s_i, s_{i-1}) \leq t$



FORMING FACE TRACKS (CONT.)

A character in different tracks

Example (Shot #6)

exemplar faces

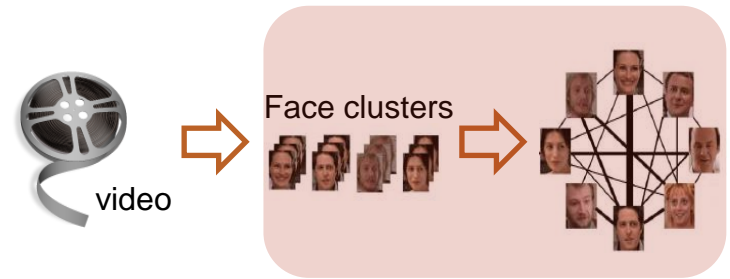


#face in track ≥ 10 \rightarrow preserve

#face in track < 10 \rightarrow discard

AP Clustering

CONSTRUCTING SOCIAL NETWORK

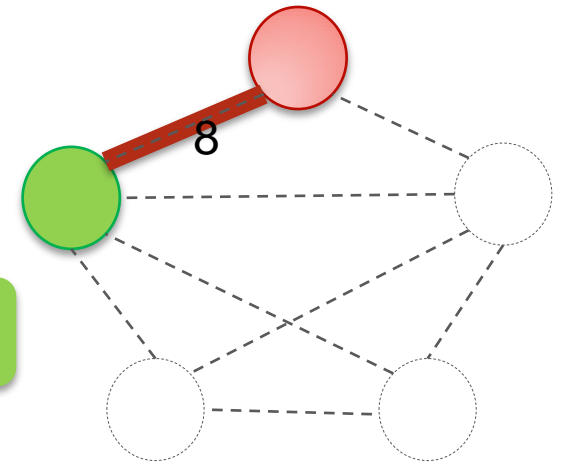
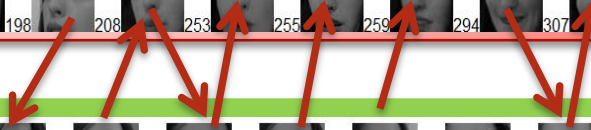
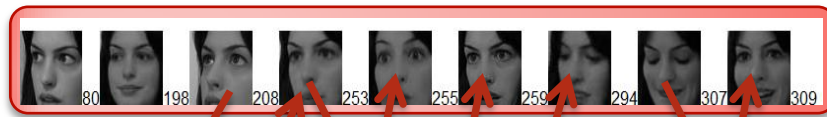


- We use both **co-appearance** and **interaction** for measuring characters' social closeness.



CONSTRUCTING SOCIAL NETWORK

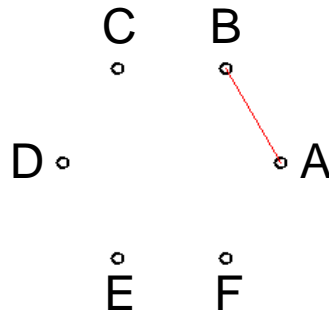
Shot alternation rule: two consecutive shots usually show a different character



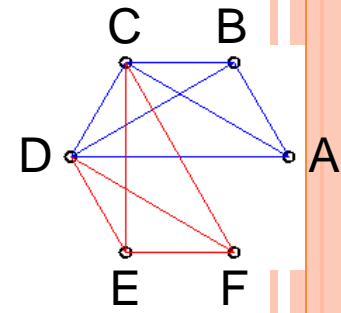
COMBINING CO-APPEARANCE AND INTERACTION

create (E, F)
 (C, E) (C, F) (D, E) (D, F)

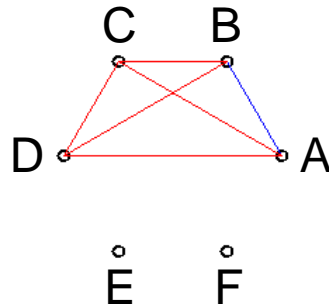
shot t



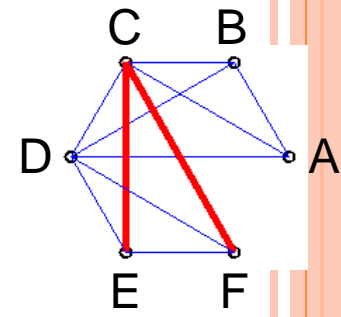
shot $t+2$



shot $t+1$



shot $t+3$



create (C, D)
 (A, C) (A, D) (B, C) (B, D)

increment (C, E) (C, F)



SUMMARY OF OUR APPROACH

- The amount of interactions between two characters is estimated by the number of shot alternations in the film.
- Require only the shot boundaries
- Conceptually simple and easy to implement



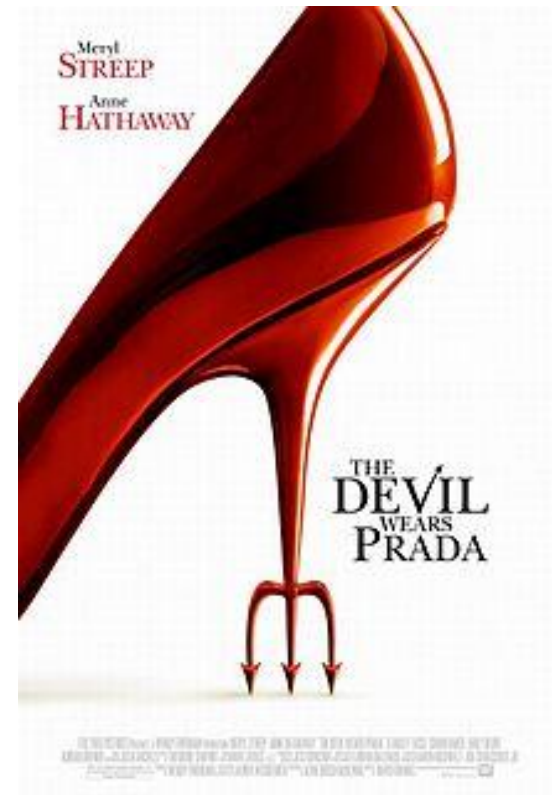
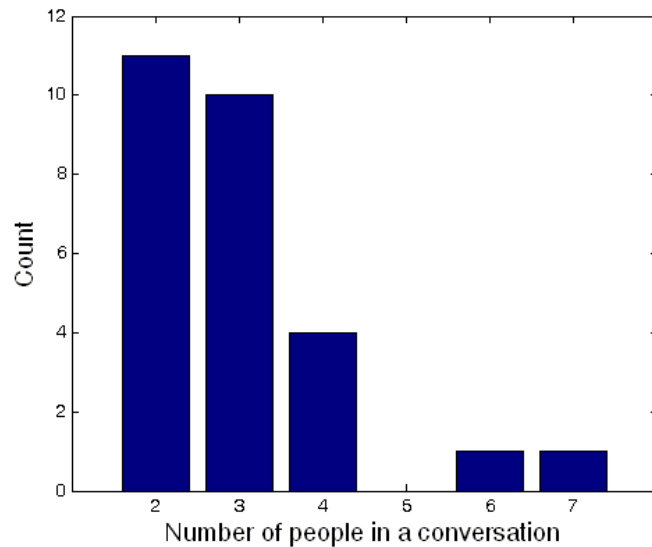
OUTLINE

- Introduction
- Approach
- Experimental results
 - Automatically constructed social network
 - Relationship chart
- Conclusion and future work



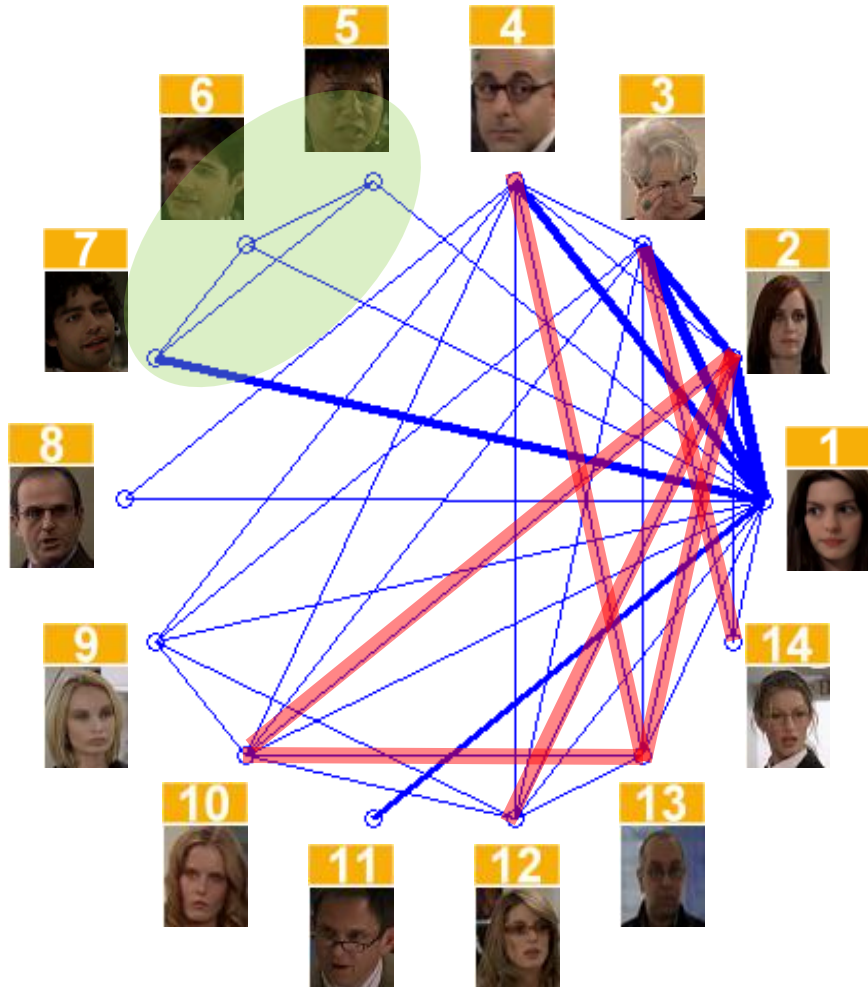
DATASET

- The Devil Wears Prada
 - A segment of 36 minutes
 - 1090 shots
 - 27755 faces
 - 14 characters

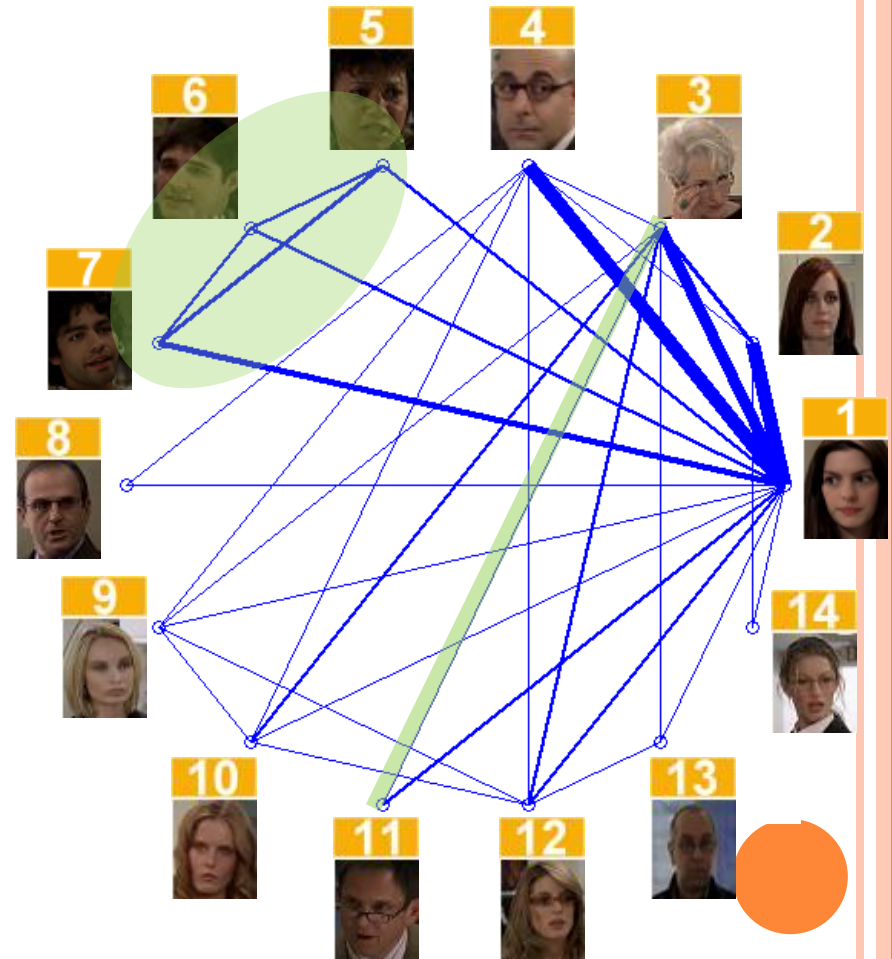


SOCIAL NETWORK BUILT UPON MANUALLY LABELED FACES

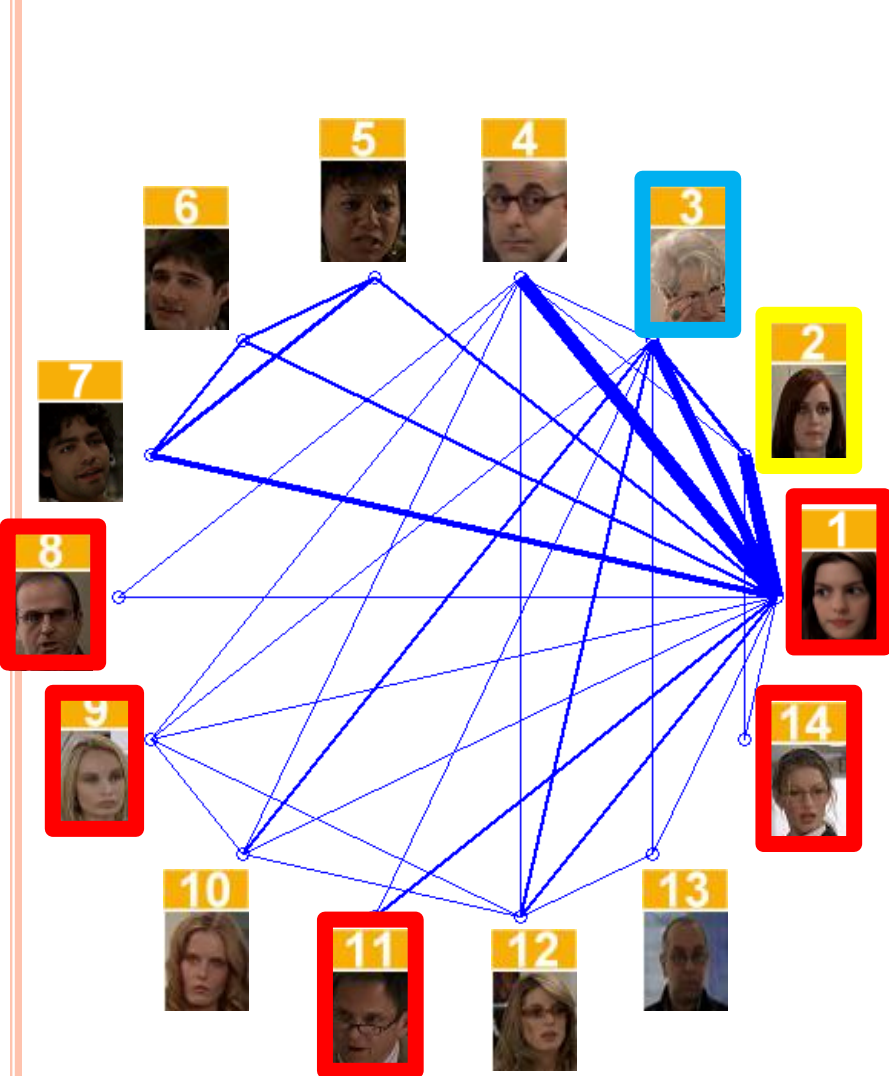
co-appearance



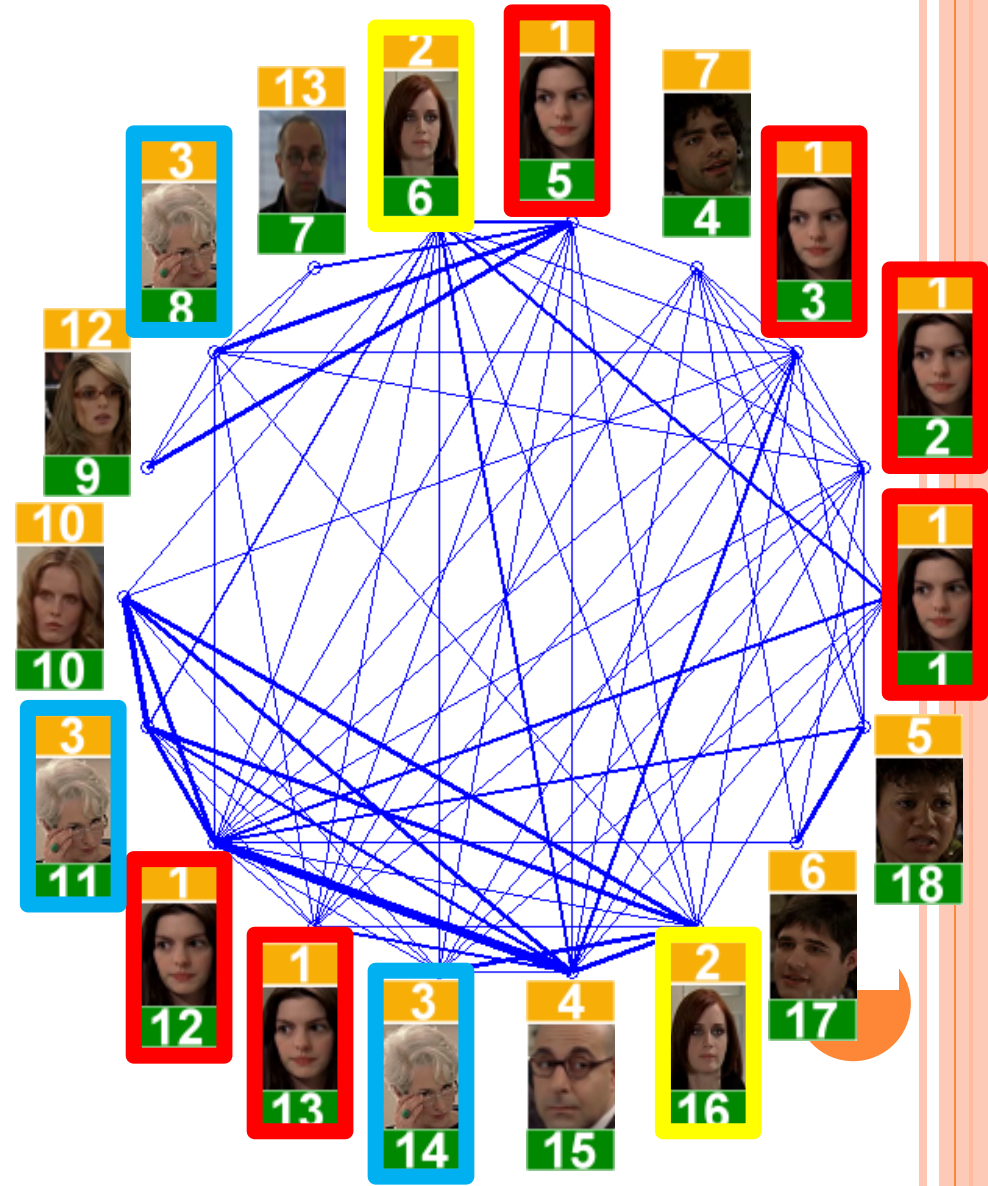
interaction



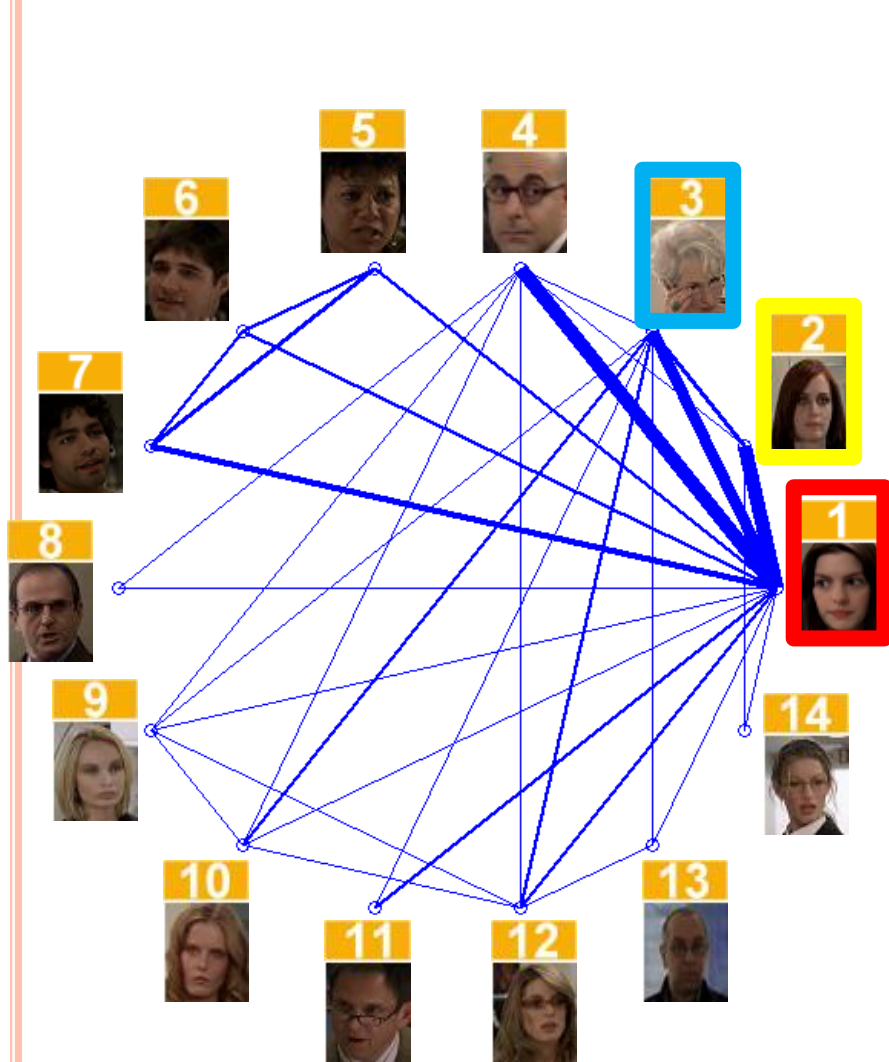
- Manually labeled
 - 14 characters



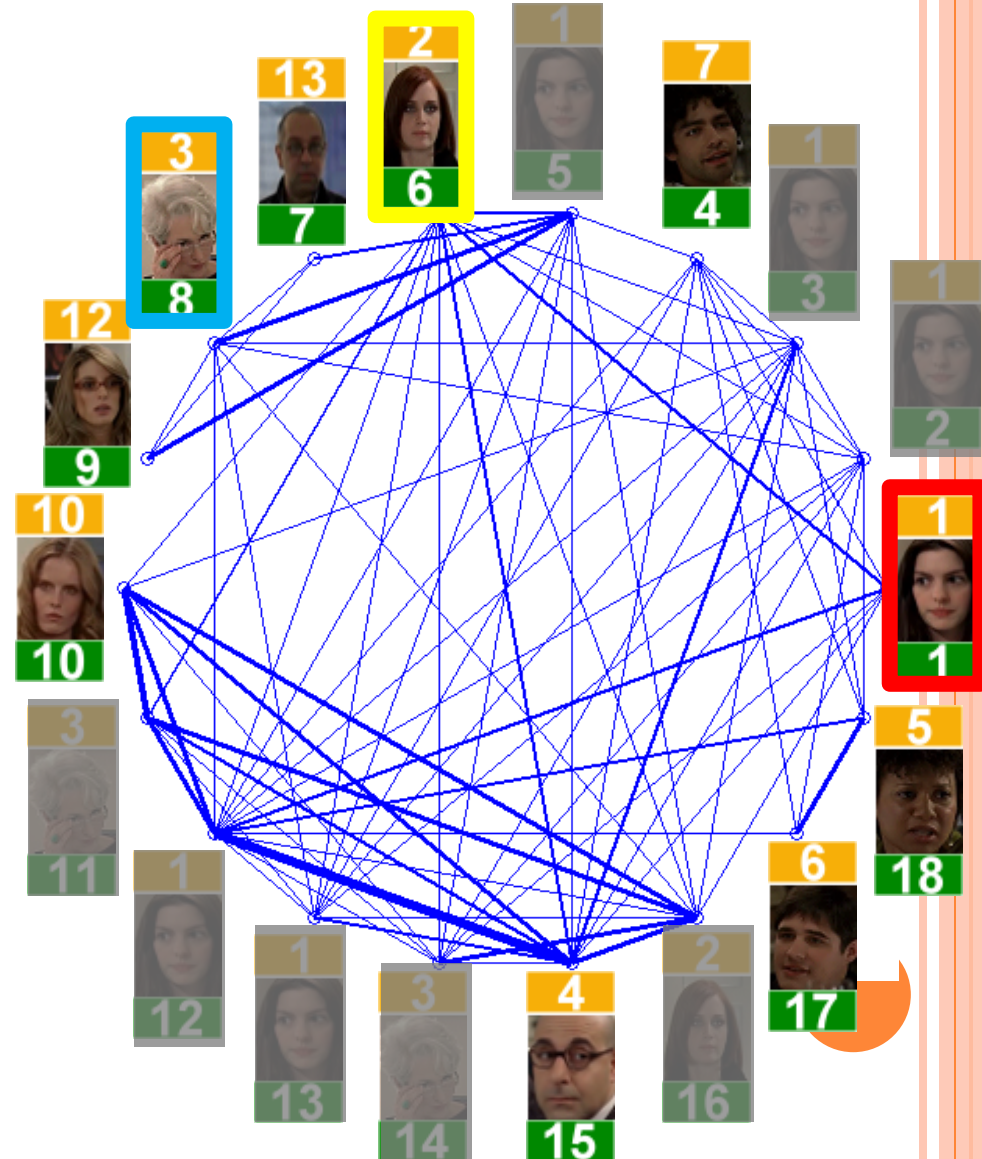
- Automatic approach
 - 18 clusters (10 characters)



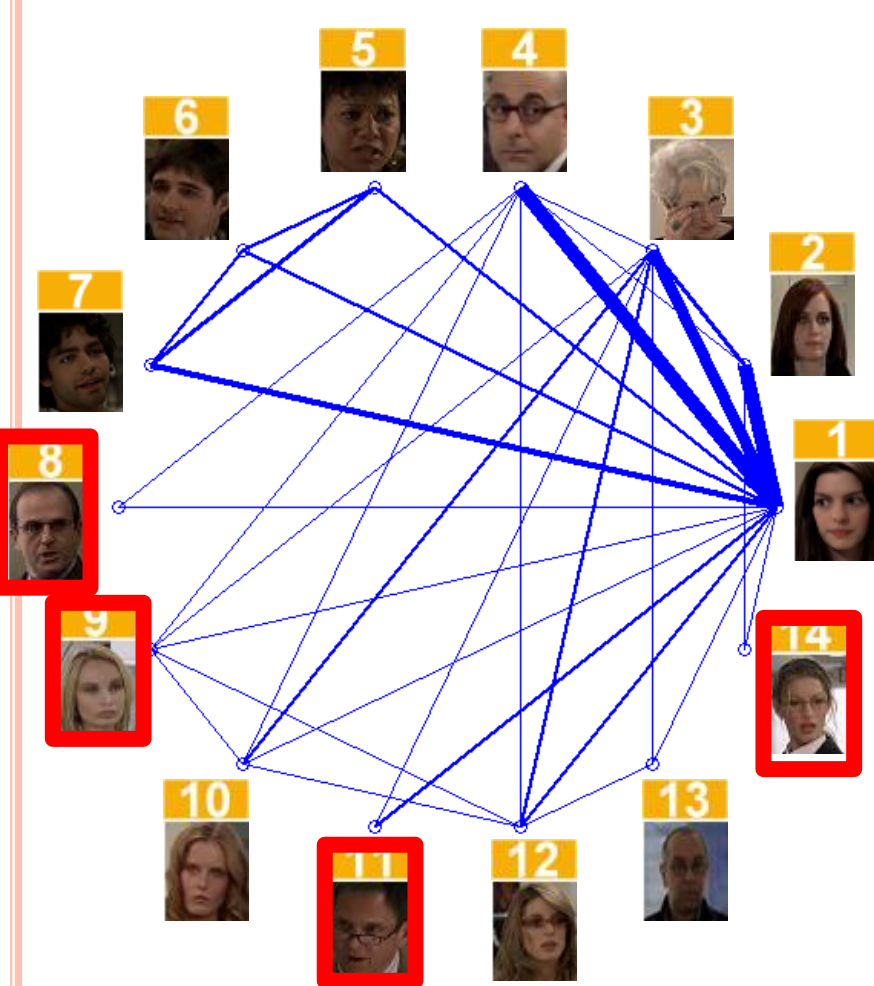
- Manually labeled
 - 14 characters



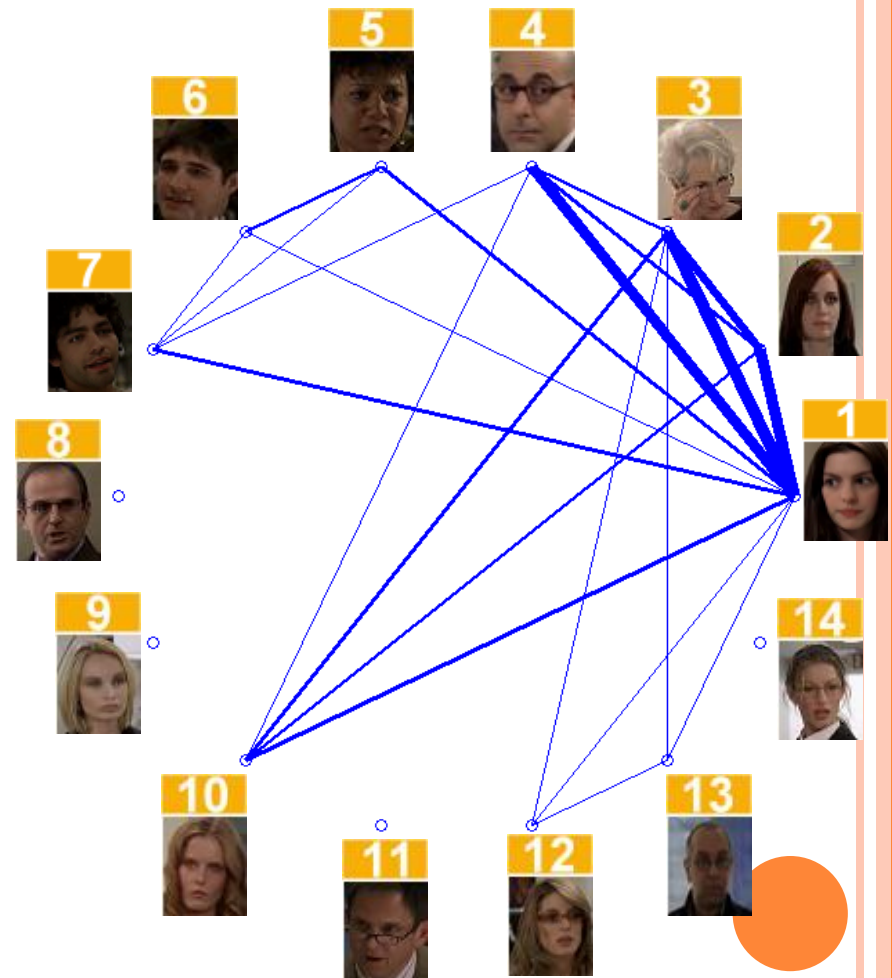
- Automatic approach
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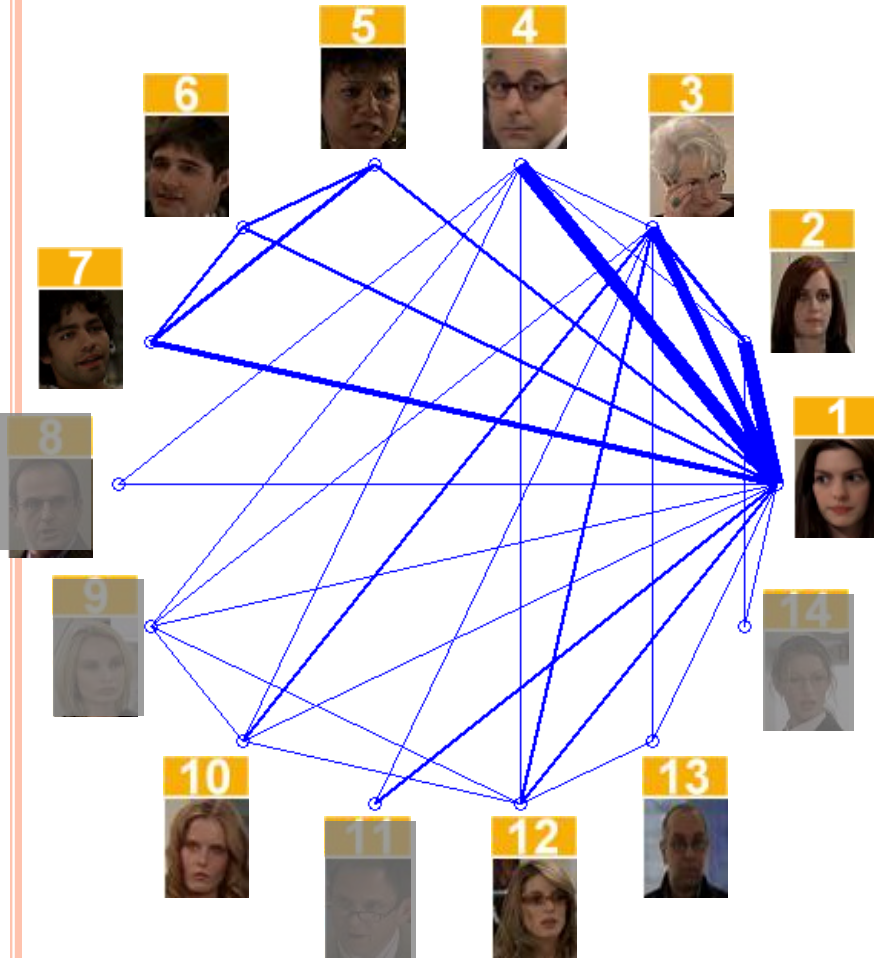
- Manually labeled
 - 14 characters



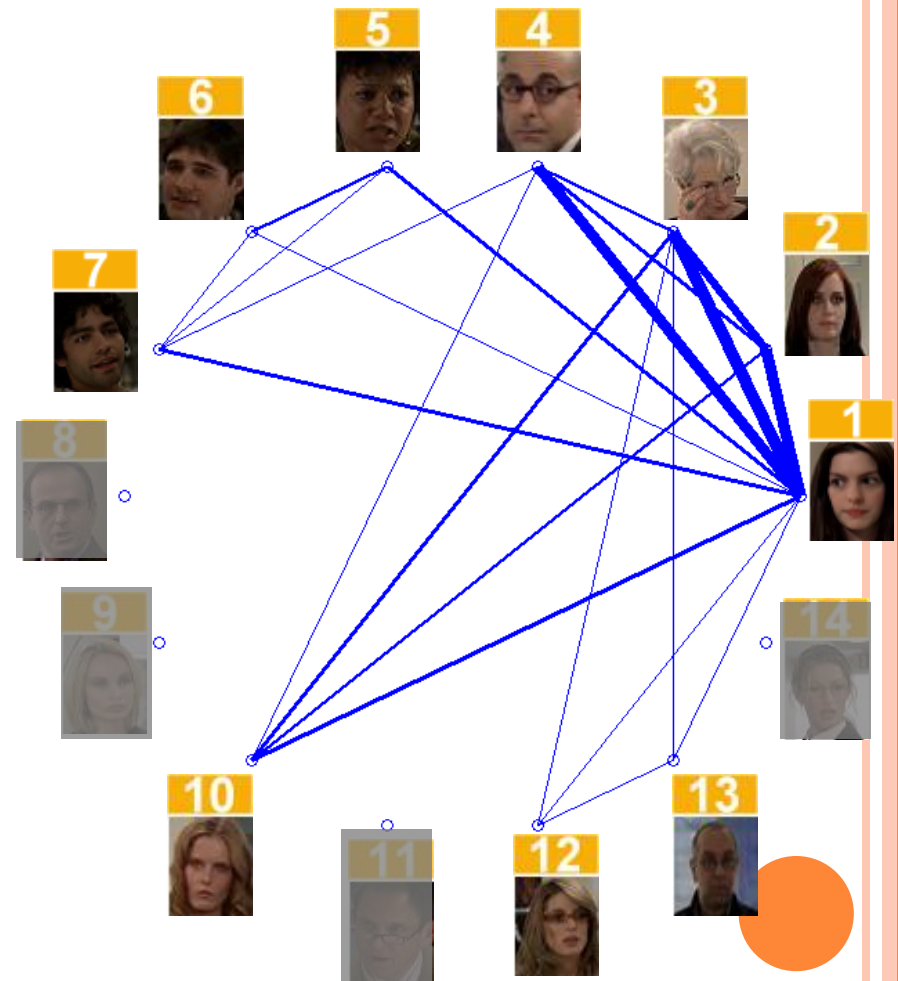
- Automatic approach
 - merging clusters of same person



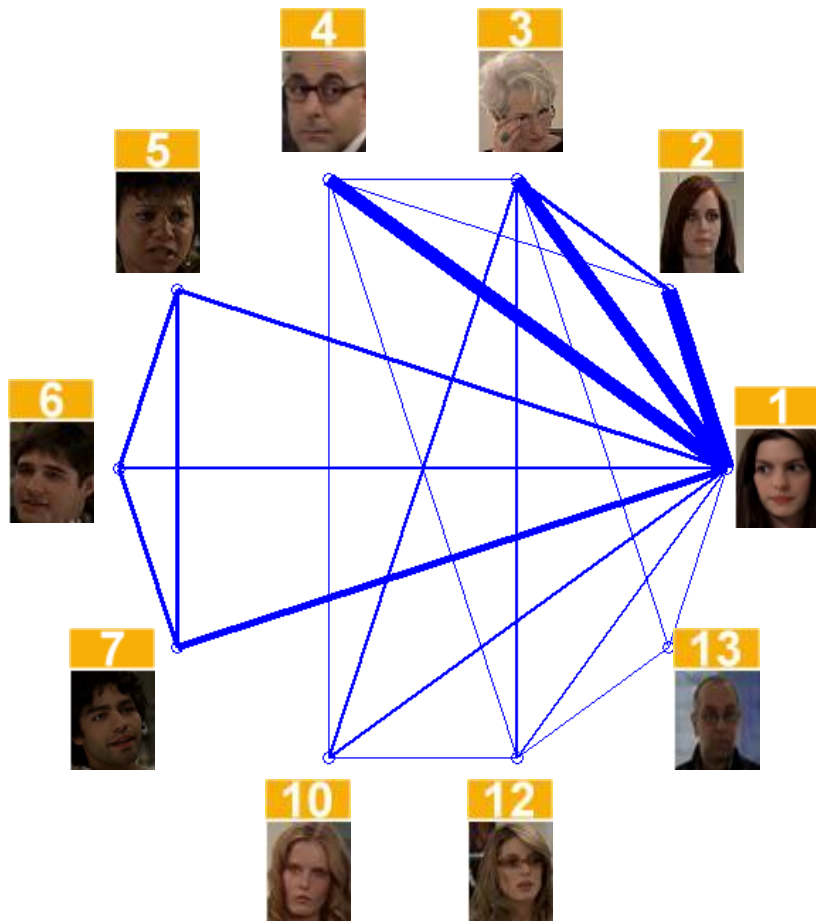
- Manually labeled
 - 14 characters



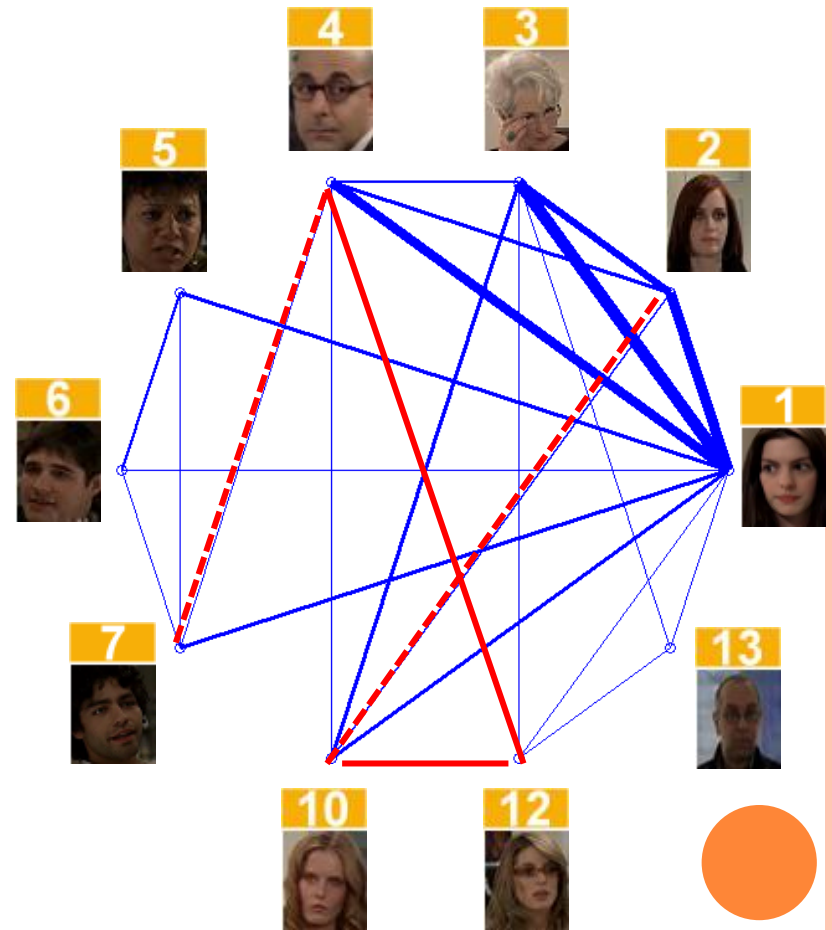
- Automatic approach
 - merging clusters of same person



- Manually labeled
 - 10 characters

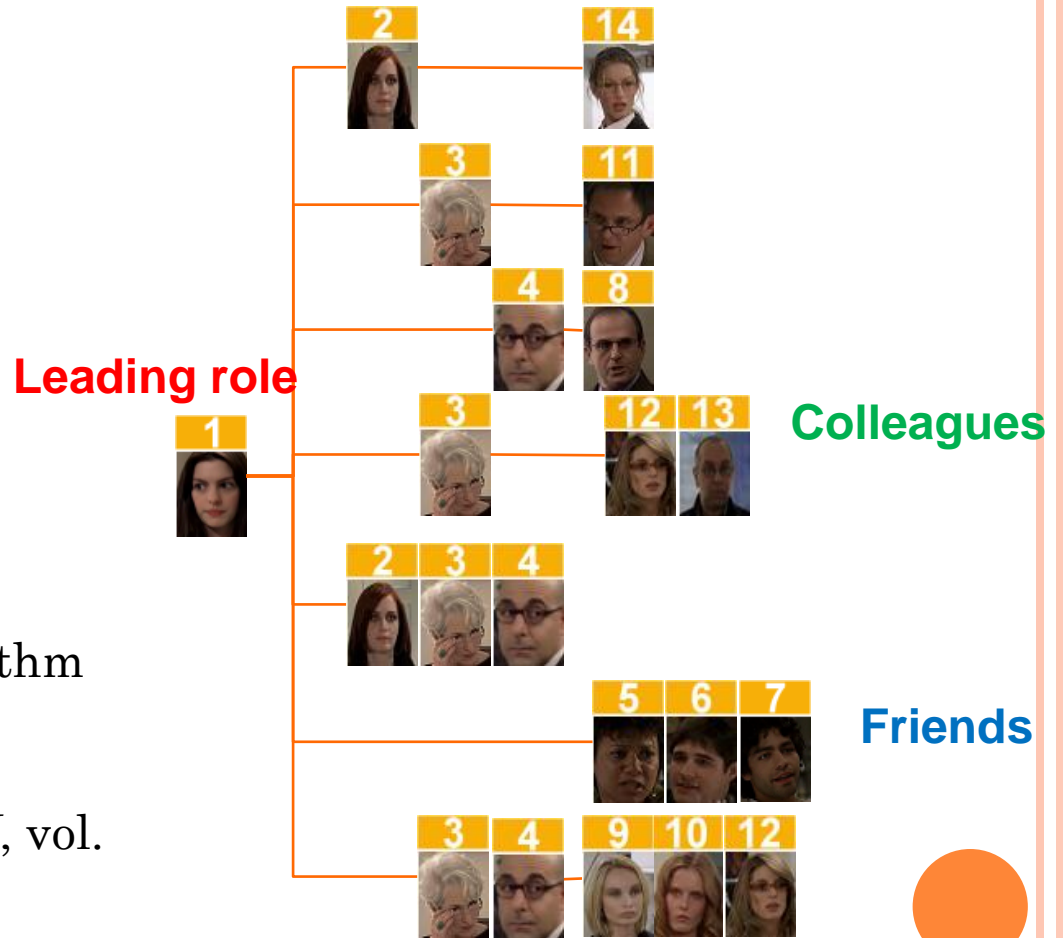


- Automatic approach
 - merging clusters of same person
 - removing four characters



APPLICATION: RELATIONSHIP CHART

- Communities →
Maximal Cliques in
the Social Network



B. Coen and K. Joep, “Algorithm 457: finding all cliques of an undirected graph,”
Communications of the ACM, vol. 16, pp.575-577, 1973.

CONCLUSION AND FUTURE WORK

- An automatic approach to construct characters' social network from movies
- A new scheme that measures the social closeness of characters based on their interactions
- Future Work
 - Use of the automatically constructed social network for organizing movie contents
 - A significant improvement of the purity rate in face clustering





THANK YOU

More information:

<http://www.csie.ntnu.edu.tw/~myeh>