Network Visual Analytics of News Videos based on Facetracking

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Abstract

The current advances in the domain of computer vision bring us new tools to perform high-level analysis. News analysis has been an important focus of visual analytics systems. Social networks analysis is also a key tool for conducting sociologic studies in news media. In this paper, we propose to bring the three domains together: we present a visual analytics system to explore news media from social networks derived from video analysis. The social networks are created from facial detection and tracking of over ten years of the Japanese NHK news archive. The interactive visual exploration of the different social networks offers then a comparative view of the politico-media scene presented by NHK between 2001 and 2013.

Index Terms: Human-centred computing [Visualization]: Visual Analytics—Social Networks

1 Introduction

In the age of data processing, news videos are rich mines of information. Investigating the news became naturally the topic of many visualization and analysis systems. Many exciting challenges were raised in that matter, especially in monitoring the topical landscape from the large flow of information to which we are exposed today. Monitoring and understanding the news can help public figures in managing their public image, as well as support the work of journalists, social scientists and other media experts. But since a lot of news are presented using video, we can also use the visual information to bring a new angle on this news data: many public figures appear together in different news stories, and this can be used to define social interactions. A first task we can tackle is the exploration of news content from the perspective of the social networks of public figures. We propose a video analysis approach to construct social networks from news, which offers a new way to access news videos. After discussing the related works, we will present our data, the face tracking approach, and the exploration of the social networks derived from facial detection and tracking of about twelve years of the NHK news archive. Supported by domain knowledge, the interactive visual exploration of the different social networks offers then a comparative view of the politico-media scene presented by NHK between 2001 and 2013.

2 Related Works

News analysis is a fertile ground for visual analytics contributions. It has been used to help exploring large trans-media news as in [2], [5] and [7] from which not only text but also visual information is used. Faces are also used in the case of [8], which fuses many criteria and modalities to support user's exploration of stories in the corpus, and introduces a network of topics, similarly to [11]. Predictions based on topical information in news analysis have shown very interesting results as in [4] and [12]. Analysis derived from large scale data [10] also includes political figures co-occurrence analysis, represented as networks.

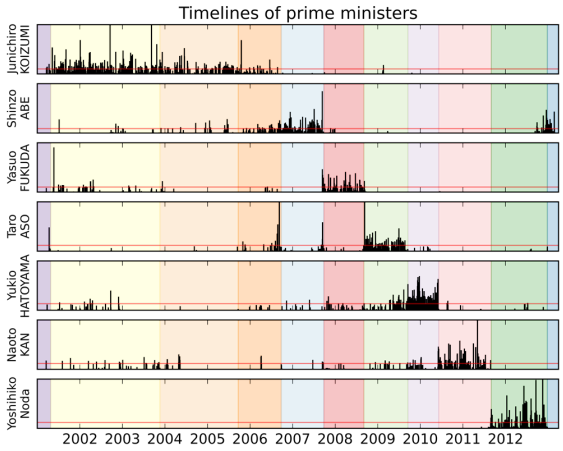

Figure 1: The different time lines for each of the PM reflects well their mandate (as presented in the background colors). Notice the differences in patterns of time apparition for each PM.

3 Analyzing faces in 12 years of NHK

The dataset we are considering consists of a daily archived news video programs from the main Japanese public channel NHK airing at 19:00 (namely NHK News 7), and collected within the NII-TVRECS archive [6]. The capture covers a period between March 17, 2001 and February 27, 2013. 4,259 news programs have been collected cumulating about 2,102 hours (6.7TB of video). The few missing captures, concerning mostly the beginning of the time period, are due to the system setup. Most of the programs last 30mn with a few of them falling below or beyond this format (Sundays editions and commemorative events).

The news programs are divided into segments, corresponding to the different stories narrated within a program. We thank the authors of [3] for lending us the corresponding segment boundaries data. Overall, taking into account the differences of lengths among programs, this summarizes to an average of 13.7 segments per day.

We then extracted face-tracks in the whole video archive using the method described in [9]. The process follows several steps. We first apply a face detection algorithm (using the Viola Jones detector). Next, we use the KLT point tracker among all videos. We can regroup the different track points falling within a detected face to form a single face-track. We sample then a few (20) faces in a single face-track, to obtain a *mean face* using VGG face descriptors. Face-tracks can finally be matched together based on the distance between their *mean faces*. This process returns over 30M faces with 170k detected face-tracks in the whole dataset.

As a first experiment, we gave a sample of 5k face-tracks to be annotated by our lab members. 139 different public figures have been recognized in this dataset, and we obtained over 20k face-tracks by retrieving from these annotations. The 139 individuals are detected in 20k face-tracks covering a total of 36h of programs

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in the video archive (about 1.2% of the archive), with up to 7 individuals detected per news segment. The inter-day distribution of character occurrence shows a very high peek at 1-day difference for most of the individuals, characteristic of bursty data. Although this means we may have little chances to find overlaps between individuals, the average detected people per news segment (of 1.3) suggests us these overlaps exist and may be exploited for analysis.

4 Social Networks of Public Figures

The application domain we are interested in focuses on the social analysis of the political activities presented by NHK, so we want to bring a particular focus on political figures. During the considered period of time, the politics of Japan has repeatedly seen changes among its leadership. We are interested in observing how this reflects on the people appearing in NHK News 7.

Before we jump onto the social network definitions, we need some background information to interpret relationships between the 139 people detected. A little domain knowledge indicates that we have 96 Japanese and 43 international people, divided into categories corresponding to what they are well known for: *Politics* (71), *Sports* (27), *Culture* (11), *Business* (7), *Imperial family* (5), *Journalism* (4), *Religion* (3), *Law* (3), and *Other* (5).

Incidentally, the *Politics* class includes 23 international leaders (presidents, prime ministers...). The 7 Japanese Prime Ministers – hereafter referred as PM – governing during the whole period of capture are of course represented, allowing us to create time frames covering their cabinets. We obtained then 11 time periods reflecting the different cabinets of the PM as in Figure 1.

For each of these periods of time, we can derive a network in which a node is a public figure and a link is connecting individuals whenever they have been detected in the same news segment. We then weighted the nodes depending on how many news segments individuals appeared in, as well as the links with segment co-occurrences. Additionally, we have labeled the politicians from the different parties they belonged to during the different periods of time and used them as colors.

We developed our prototype on top of Tulip [1], the graph drawing framework. The different networks are coordinated such as nodes and links can be selected and highlighted across different networks for comparison tasks (Figure 2). To each selection – nodes and/or links – corresponds a series of news video segments, for (co)occurrence of politicians within the current cabinet. In one active network, given the user's selection, we enabled a pop-up access to play the video segments corresponding to the selection. We also added a few specific interactions: one hides the prime minister of the current network to better highlight the current interactions between politicians; another one highlights the selection in the timeline of the current cabinet.

5 Conclusion

The exploration of these networks brings us a clear idea of the different politicians at play on NHK during the different periods of time. NHK is a national channel, and as we expected, the different networks actually reflect well the policy of the parties in power. We could then observe the rise of popularity of Shinzo Abe during Koizumi's cabinets before he became himself prime minister. We could additionally spot specific individuals such as Ichiro Ozawa – also infamously known as the *Shadow Shogun* – changing a lot his affiliation and links and whose centrality evolved strongly during the different cabinets, even though he was not a prime minister.

Although this prototype offers a new way to access videos directly from a network exploration, this experiment opens for many future works. We want to improve the face tracking, add many other public figures, compare different channels, and add semantic information. In terms of visual analytics, the temporal and highly heterogeneous nature of our data challenges us towards dynamic

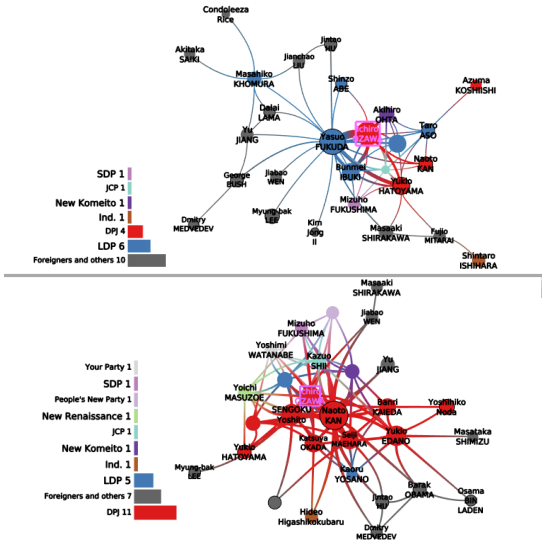

Figure 2: Two coordinated networks, with *Ichiro Ozawa* as an highlighted node. Bottom is Kan's cabinet, and top is Fukuda's cabinet.

representations, and invites us to design new representations and interactions to *discover the unexpected*.

References

[1] D. Auber, D. Archambault, R. Bourqui, M. Delest, J. Dubois, B. Pinaud, A. Lambert, P. Mary, M. Mathiaut, and G. Melançon. Tulip III. In R. Alhajj and J. Rokne, editors, *Encyclopedia of Social Network Analysis and Mining*, pages 2216–2240. Springer, 2014.

[2] N. Hervé, M.-L. Viaud, J. Thièvre, A. Saulnier, J. Champ, P. Letessier, O. Buisson, and A. Joly. Otmedia: the french transmedia news observatory. In *Proceedings of the 21st ACM international conference on Multimedia*, pages 441–442. ACM, 2013.

[3] I. Ide, H. Mo, N. Katayama, and S. Satoh. Topic threading for structuring a large-scale news video archive. In *Image and Video Retrieval*, pages 123–131. Springer, 2004.

[4] I. Ide and F. Nack. Explain this to me! *ITE Transactions on Media Technology and Applications*, 1(2):101–117, 2013.

[5] M. Itoh, M. Toyoda, C. Z. Zhu, S. Satoh, and M. Kitsuregawa. Image flows visualization for inter-media comparison. In *Pacific Visualization Symposium (PacificVis), 2014 IEEE*, pages 129–136. IEEE, 2014.

[6] N. Katayama, H. Mo, I. Ide, and S. Satoh. Mining large-scale broadcast video archives towards inter-video structuring. In *Advances in Multimedia Information Processing-PCM 2004*, pages 489–496. Springer, 2005.

[7] N. Katayama, H. MO, and S. Satoh. Enhanced visualization of news shot cloud with employing circular layout. In *Proceedings of the 8th International Symposium on Visual Information Communication and Interaction*, pages 166–167. ACM, 2015.

[8] H. Luo, J. Fan, J. Yang, W. Ribarsky, and S. Satoh. Analyzing large-scale news video databases to support knowledge visualization and intuitive retrieval. In *Visual Analytics Science and Technology, 2007. VAST 2007. IEEE Symposium on*, pages 107–114. IEEE, 2007.

[9] T. D. Ngo, H. T. Vu, L. Duy-Dinh, and S. Satoh. Face retrieval in large-scale news video datasets. *IEICE TRANSACTIONS on Information and Systems*, 96(8):1811–1825, 2013.

[10] C. Seifert, V. Sabol, W. Kienreich, E. Lex, and M. Granitzer. Visual analysis and knowledge discovery for text. In *Large-Scale Data Analytics*, pages 189–218. Springer, 2014.

[11] M.-L. Viaud, J. Thièvre, H. Goëau, A. Saulnier, and O. Buisson. Interactive components for visual exploration of multimedia archives. In *Proceedings of the 2008 international conference on Content-based image and video retrieval*, pages 609–616. ACM, 2008.

[12] H. Yeon and Y. Jang. Predictive visual analytics using topic composition. In *Proceedings of the 8th International Symposium on Visual Information Communication and Interaction*, VINCI '15, pages 1–8. ACM, 2015.