

# Visualizing Flows of Images in Social Media

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## ABSTRACT

Mass and social media provide flows of images for real world events. It is sometimes difficult to represent realities and impressions of events using only text. However, even a single photo might remind us complex events. Along with events in the real world, there are representative images, such as design of products and commercial pictures. We can therefore recognize changes in trends of people's ideas, experiences, and interests through observing the flows of such representative images. This paper presents a novel 3D visualization system to explore temporal changes in trends using images associating with different topics, called Image Bricks. We show case studies using images extracted from our six-year blog archive. We first extract clusters of images as topics related to given keywords. We then visualize them on multiple timelines in a 3D space. Users can visually read stories of topics through exploring visualized images.

## 1 INTRODUCTION

Mass and social media such as blog, twitter, and Flickr provide flows of images with time stamp for real world events. Even a single image provides realities and impressions of complex events. Images play a role as an effective proxies for a content to visually tell stories of our interests and experiences [1].

We can observe changes in trends of interests of people and society through chronologically exploring the flowing images. Exploration for the images enables us to visually grasp situations and timings of events that people have participated in. We can understand how the news programs report interesting events through observing pictures on news contents. We can recognize changes in key persons and objects related to politics and happenings. It also allows us to observe changes in popularity of design of products and commercial pictures.

Many systems to visualize changes in trends of topics extracted from textual contents have been provided [2, 4, 6]. In the case of image contents, Leuken et al. [5] extract clusters from retrieved images, however, they did not mention temporal changes in clusters. Gomi et al. [3] visualize images categorized by time, location, and person in a life log data, however, they did not visualize thematic changes in other aspects. Flake's Pivot<sup>1</sup> provides visualization of cover photos of magazines from a particular facet. His method uses a histogram displaying images in each year from the selected facet. On the other hand, our system enables us to simultaneously compare histograms of images from different aspects.

In this paper, we propose a novel visualization system to explore time varying changes in trends using images on timelines, called Image Bricks. To visually analyze trends from flows of images describing various topics, first, a function for visualizing a flow of various images in each timing is required. We therefore adopt a

histogram of images by stacking images on a timeline. This design enables us to find out the beginning timing of the topic, changes in trends of the topic, bursting points, and a lifetime of the trends. Second, a function for visualizing images on different aspects is necessary to easily compare multiple situations. We hence arrange multiple histograms of images in a 3D space. This design allows us to observe different situations between different topics, sequence of trends, and events in the same timing in different topics.

This paper introduces a system for visualizing trends extracted from images on the blog as case studies. To visualize changes in trends in the blogosphere, we first extract clusters of images as topics from our six-year blog archive. We then visualize them using our system. We can analyze temporal changes in society and read some stories related to the specified keywords through exploring visualized images.

Our approach can be applied not only to blog contents but also to other kinds of media such as Flickr, life log, and news contents.

## 2 VISUALIZATION AND EXPLORATION

Our system visualizes changes in images in topics in a 3D visualization space. It uses x-axis for the timeline, y-axis for stacking images in the topic with a specified time window, and z-axis for arranging topics.

Figure 1 visualizes 20 topics about given keywords related to "Prime Minister Hatoyama". Each topic is colored differently. A frame of each image uses the same color in each topic. Timelines for topics are also colored by topics' colors. These colored lines represent topics' active periods. Images in a topic are aggregated per a specified time window, such as one month, one week, or one day, and are stacked on the timeline (described as a histogram of images). In Figure 1, we aggregate images every week. Labels that annotate topics can be visualized under the stacks of images. We can display arbitrary number of labels, but we normally visualize one or two labels from the point of view of readability.

It enables users to zoom, rotate, and pan the 3D space to interactively change a region being focused on and to avoid occlusion problem. Moreover, users can interactively pick images to zoom in and see them in detail. The selected images are highlighted and the floor panels that have the same time windows with the selected images are also highlighted to support to compare multiple topics. Users can access original information including the selected images. The system has also a function to connect with our text based analyzing and visualization system [4] to explore trends related to the keywords and the selected timings in detail.

## 3 CASE STUDIES

We first retrieve images and text around images related to a given query from our six-year blog archive to visualize changes in trends in the blogosphere. We next extract clusters of the images from similarity matrix based on image features, textual features, and time stamps. We treat extracted clusters as topics of images associated with the query, and then rank clusters to select important topics and remove noises. For this purpose, we first calculate weight of images from image similarity. We then calculate a score of each cluster from weights of images included in the cluster, and rank clusters

<sup>1</sup>[http://www.ted.com/talks/gary\\_flake\\_is\\_pivot\\_a\\_turning\\_point\\_for\\_web\\_exploration.html](http://www.ted.com/talks/gary_flake_is_pivot_a_turning_point_for_web_exploration.html)

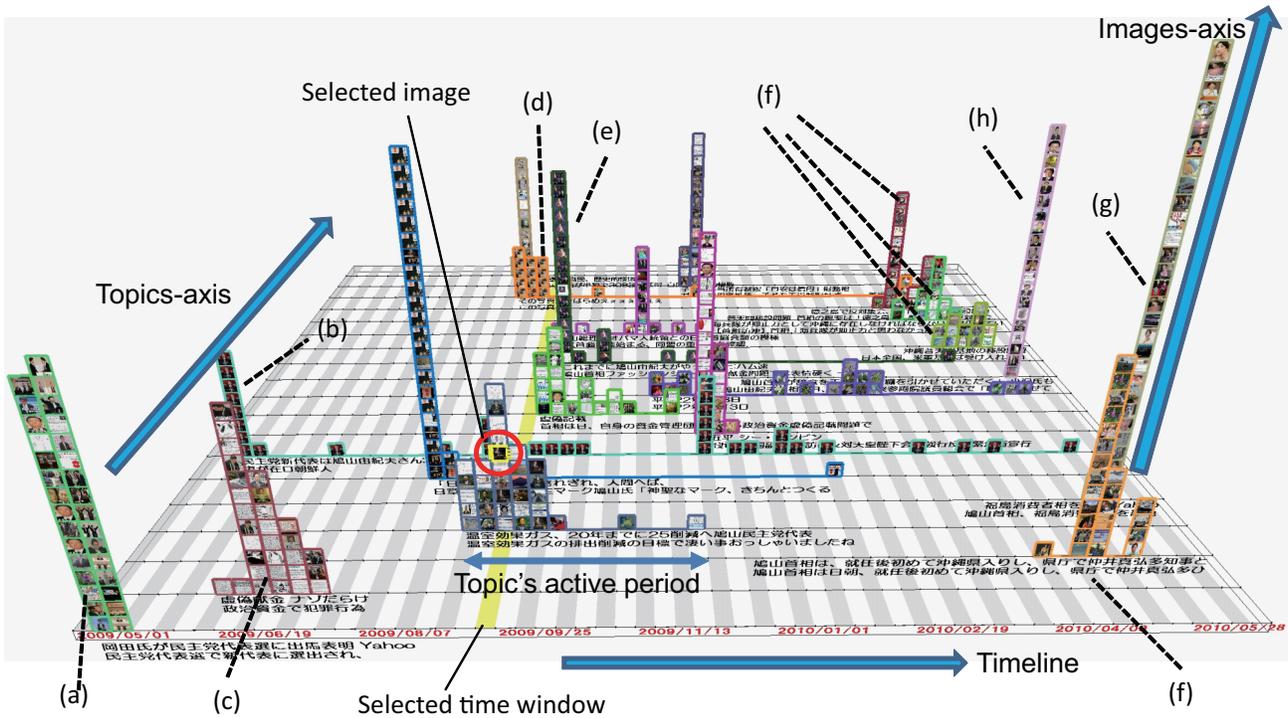


Figure 1: Example for visualizing changed in clustered images about a given query related to “Prime Minister Hatoyama”.

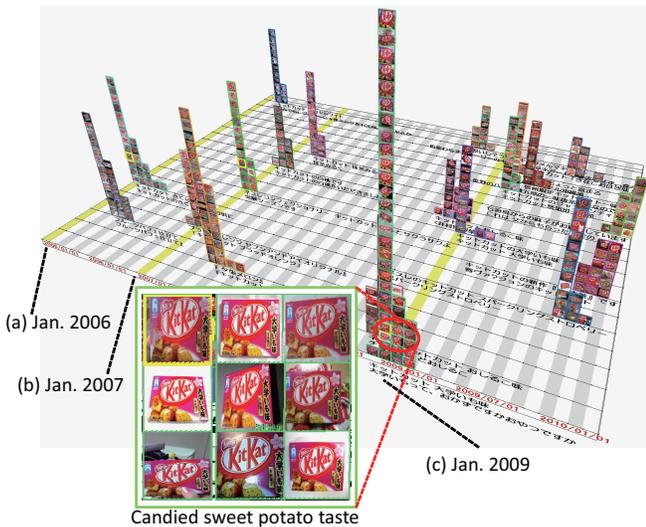


Figure 2: Visualizing changes in trends related to varieties of “Kitkat”

based on calculated scores. Moreover, we extract labels for clusters from text around images to annotate topics.

Figure 1 visualizes clustered images about a query related to “Prime Minister Hatoyama”. In this example, top-20 clusters are arranged from front to back according to clusters’ ranks. We can read a story of “Prime Minister Hatoyama” through exploring movements of topics; (a) election of a president of the Democratic Party of Japan (after that, he took office as a Prime Minister), (b) a collage image representing “Hatoyama is a marionette of Ozawa” became popular (this cluster continues to exist till the last), (c) cluster related to false contribution scandal, (d) spreading strange photographs of his youth, (e) appearance on a fashion show (cluster (c)

and (d) become popular only on the Web though social media), (f) the problem of the relocation of a U.S. military base on Okinawa Island became huge (there are four clusters related to this problem), (g) dismissal of a cabinet minister (because of the problem described in (f)), and (h) resignation.

Figure 2 visualizes changes in trends of new products related to “Kitkat” in Japan. We can find out seasons that various kinds of new flavors of “Kitkat” become popular. In Jan. 2006 and 2007 in Figure 2 (a-b), “cherry taste Kitkat” become popular for “pass praying for entrance exam” because the sentence “a cherry tree blooms” is sometimes used for representing “success in an examination” in Japan and “Kitkat” means “surely win” in a play on words in Japan. In Figure 2 (c), cluster related to “candied sweet potato taste Kitkat” becomes popular in Jan.2009 for almost the same reason.

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