Exploring the Habit of Digital Animals: a Network Analysis of the Anime Illustrations

Sean Zhao[5] Yehong Deng[6]

Center for Statistics and the Social Sciences, University of Washington

Introduction and Background

This project delves into the vibrant realms of anime and otaku culture, which are central to our research. Anime, originating from Japan, encompasses a wide range of animated works known for their rich narratives, diverse art styles, and engaging characters. Otaku culture refers to the dedicated fanbase that passionately engages with anime, manga (Japanese comics), video games, and other related media.

In studying the consumption culture of the Otaku, Hiroki Azuma (2009)[1] argued that the consumption behavior of otaku generally represents the postmodern consumption of culture, which sacrifices the search for greater significance to almost animalistic instant satisfaction. In this context, anime culture becomes a database of plots and characters and its consumers mere "database animals". Put it simply, the anime fandom culture is essentially a consumption patterns which centers around specific sets of combinations in plot and character tropes.

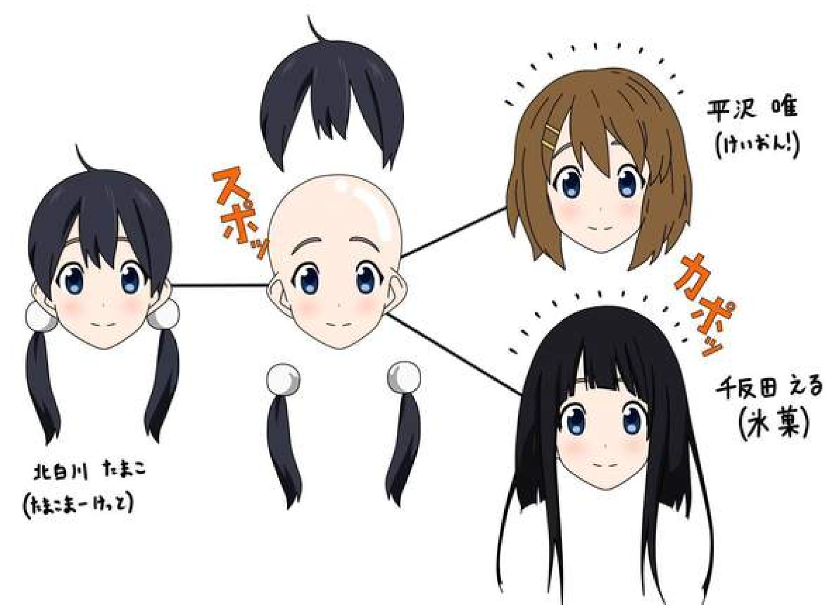


Figure 1. An illustration of the "database" culture of the anime

This project attempts to use the network method to commit an exploratory data analysis by examining whether tags in an anime illustration web archives cluster based on specific tropes, as Azuma's postulation described.

Data Collection

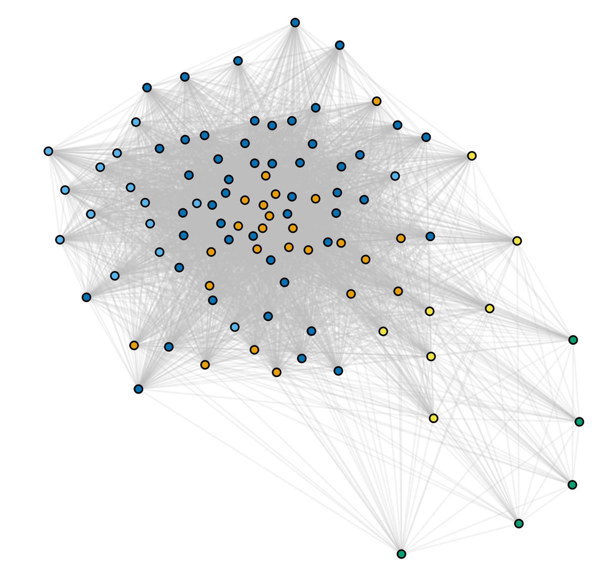
This project primarily use the dataset "Safebooru - Anime Image Metadata" download through Kaggle. The data was scraped via Safebooru, a tag-based image archive maintained by anime enthusiasts. The original data contain about 3 millions rows of the metadata, containing images uploaded to safebooru.org in the time range of 2010-01-29 through 2019-06-07. For this final project, we only take the top 1000 scored images in the latest month in the data.

Tag Relationship and Cluster Dectection

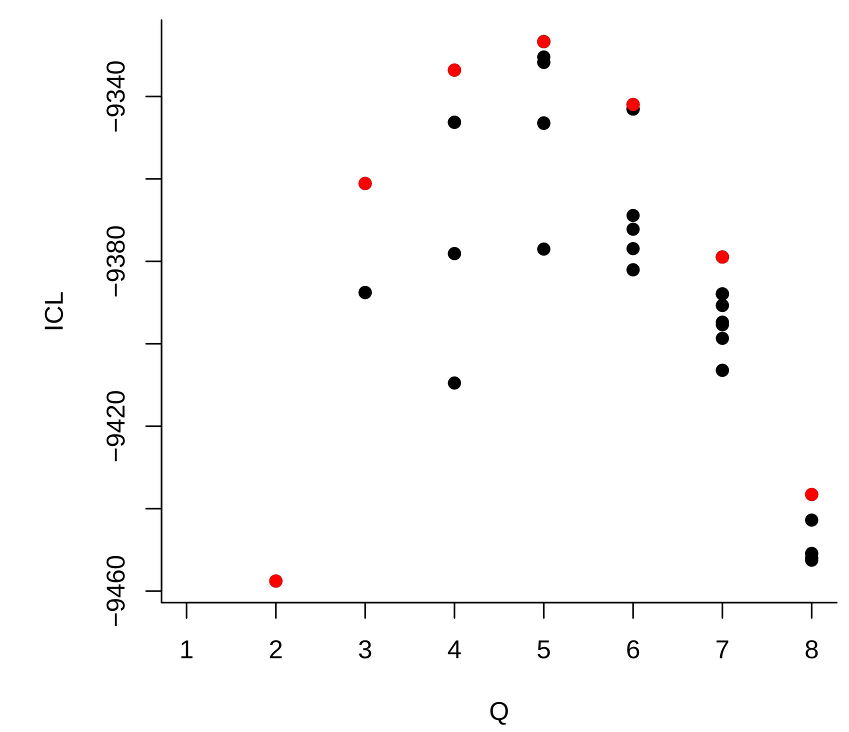
We used the tag co-occurrence to build our network. In other words, we treated each tag as a node in our network, and whenever two tags are used to describe a single image, an edge will connect the two nodes(tags). In Figure2a, we show the overall layout for the tags.

In the network diagram, we also assigned different colors to nodes based on their clusters. More specifically, we used the stochastic block models(SBM) to help our community detection. As we can see in Figure2b, the SBM results showed that the best-fit model would have 5 clusters.

Network Layout and the SBM Community Detection



(a) The overall network layout



(b) The ICL testing for SBM

Figure 2. Network and Cluster Detection

Cluster Visualization

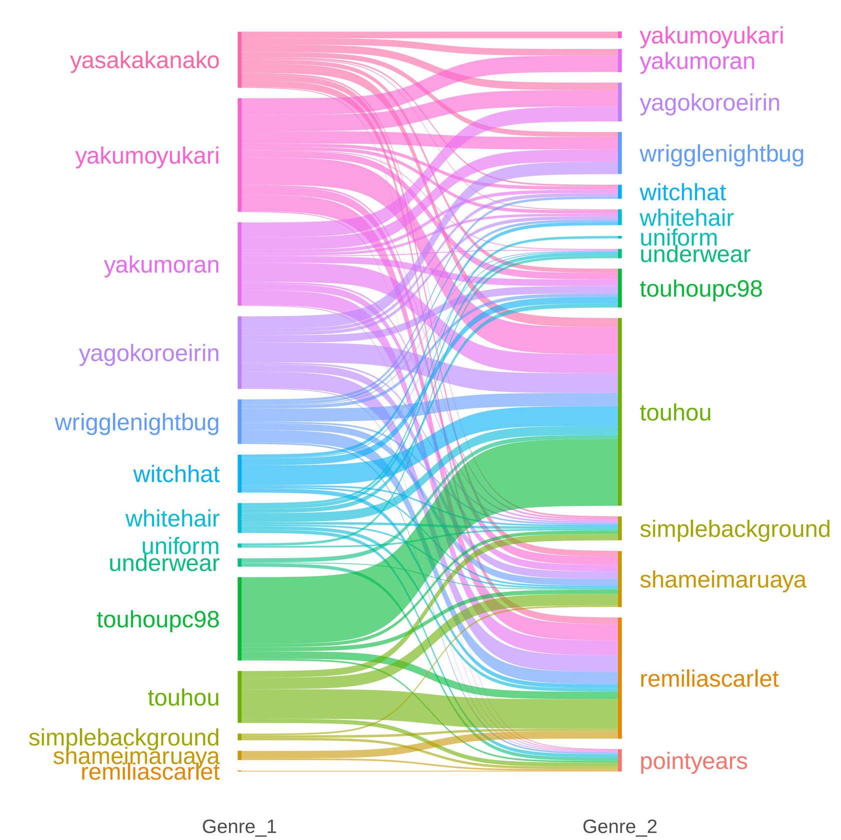


Figure 3. The Sankey Plot for Touhou Cluster

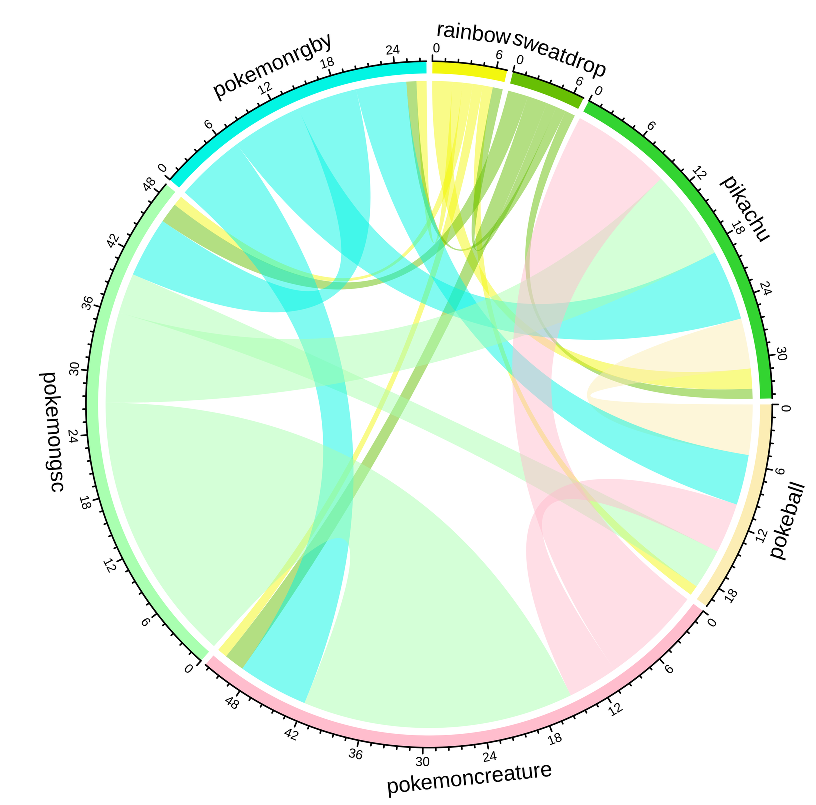


Figure 4. The Chord Plot for Pokemon Cluster

Latent Space Models and SBMs

Stochastic block models (SBMs) are an example of discrete latent space models. Latent space models assume there is some unobserved (i.e. latent) variable Z_i for each node i such that the probability of an edge between two nodes i and j is fully determined by Z_i and Z_j. In a discrete latent space, Z_i is node i's membership in one of K classes or groups.

The likelihood function of SBM

$$\hat{P}_{k,k'} = \begin{cases} \frac{1}{n_k n_{k'}} \sum_{i \in C_k, j \in C_{k'}} G_{ij}, & k \neq k' \\ \frac{1}{\binom{n_k}{2}} \sum_{i \in C_k, j \in C_{k'}} G_{ij}, & k = k' \end{cases}$$

Here, k and k' represent different communities. n_k and $n_{k'}$ are the number of nodes in communities k and k' respectively, and G_{ij} denotes the presence of an edge between nodes i and j.

For inter-group connections, the probability of an edge between communities k and k' is estimated as the number of the edge across these communities, normalized by the product of their sizes. For intra-group connections, the probability of an edge within the same community k is estimated as the number of the edge within the cluster normalized by the number of possible edges within community.

Stochastic block models using 'blockmodels'

We used the 'blockmodels' packages in R to find the best-fit model clustering. More specifically, this package uses integrated completed likelihood (ICL) to choose the best-fit clusters. The function uses a hill climbing method, which starts by fitting a one-block model then fits a model for two blocks, and so on. Each time, it computes the ICL. Once the ICL decreases, the method fits models up to 1.5 as many groups as that model.

Findings and Discussions

Using the SBM, we found 5 clusters in our network. Hence, we partitioned the overall network into 5 subgraphs to examine how tags are clustered and see if the clusters reflect specific tropes of anime, as Azuma argued. Here, we found one cluster specifically contains nodes(tags) that are closely referring to the Touhou Project, one of the most influential doujin franchise in anime. Here we visualize the subgraph in a sankey plot to show the connections between tags.

In the Pokemon cluster, we observed that the Pokemon RGBy (referring to the Pokemon Red/Green/Blue/Yellow series) and Pokemon GSC (referring to the Pokemon Gold/Silver/Crystal series) occupy substantial positions. These two series, being the first two generations of the Pokemon franchise, not only laid the groundwork for Pokemon as a global phenomenon but also had a profound impact on the design and development of subsequent games. The Pokemon characters and storylines from these two generations are beloved by fans, with many characters like Pikachu and Eevee becoming cultural icons.

Through our analysis of the tag co-occurrence network, we found that our community detection method helped us to find several anime trope-centered clusters. Hence, we can conclude that our results are consistent with Azuma's theory.

References

[1] Hiroki Azuma, Jonathan E Abel, and Shion Kono. *Otaku: Japan's database animals.* 2009.

seanzhao@uw.edu ydeng117@uw.edu