検索結果の表示方式の効果を検証するため、対象データとして図書館の著者データを用いることを提案します。
Visualizing which Parts of IIIF Images are Looked by Users

Chifumi Nishioka, Kyoto University Library
Kiyonori Nagasaki, The University of Tokyo

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Evaluating the Usage of DAs

Evaluating the usage of the digital archives is important

• Evaluation measures for the usage of digital archives
  • Number of hits, pageviews, and visitors
  • Number of accesses to each bibliography
  • Number of accesses to each image

In IIIF, an image is called via IIIF Image API with specifying a region of an image

IIIF Image API: {scheme}:://{server}/{prefix}/{identifier}/{region}/{size}/{rotation}/{quality}.{format}

IIIF enables more fine-grained analysis of usage of images
Generating Heatmaps

Analyzing IIIF Image API logs, we generate heatmaps that visualize which parts of IIIF images are looked by users.

Python Script

• Prepare $H \times W$ matrices for each image
  • $H$: height of an image, $W$: width of an image
  • Each element in matrices corresponds to each pixel
  • The size of images is retrieved from info.json

• Count the number of accesses to each pixel and record it to $H \times W$ matrix

• Generate heatmaps
  • Calculate RGB values for values in matrices
  • Output matrices as images
Speed Up

Count the number of accesses to each pixel

Count the number of accesses in N-pixel unit

Computation time for counting # of accesses (100k access logs, in which 27,736 logs are calls of IIIF image API)

10-pixel unit: 84.23 (s)
100 pixel unit: 1.09 (s)

Computer used for the experiment: iMac (macOS High Sierra version 10.13.4), Processor 4GHz Intel Core i7, Memory 16GB, 1867 MHz DDR3
Speed Up Further

Output a heatmap with the size of an original IIIF image

Output in a small size

Average computation time for generating one heatmaps (calculating RGB value for each pixel and output as an image)

10-pixel unit: 2.05 (s) (SD: 7.01)
100 pixel unit: 0.02 (s) (SD: 0.07)

Computer used for the experiment: iMac (macOS High Sierra version 10.13.4), Processor 4GHz Intel Core i7, Memory 16GB, 1867 MHz DDR3
Displaying Heatmaps over Images

- Edit IIIF manifests to overlay images
- Use Mirador’s layer function
Example
Example
Possible Applications

**Thumbnails**
- Most-viewed regions of images are used as thumbnails.

**Research Collaborations**
- Collaborators can see which parts of images have been already investigated.
- A tool to stimulate motivation for crowd-sourcing

**Understanding research process**
- Researchers can reflect their own research process.
- Young researchers can learn research methodology by looking how experienced researchers do their research.
Risks and Concerns

• Visualization of access logs is not a problem, if anonymization is conducted appropriately

• However, anonymization can be invalidated for IIIF images with few accesses
  • In the field where a small number of researchers work, peers can easily guess who accessed and investigated images

• In addition, a series of activities on IIIF images might reveal his/her viewpoint that would be a key issue of his/her academic outcome
  • Key issues can be revealed even before publication of outcome
  • Priority rights of research can be spoiled

• Therefore, we need a careful management of access logs to make services for researchers trustworthy
Future Works

• Investigate risks and concerns carefully
  • How many accesses do we need to ensure that anonymization cannot be invalidated?
  • Formulate a guideline of management and usage of access logs
• Real-time processing (i.e., stream processing)
  • How to update heatmaps as they get new accesses
• Take probabilities of being accessed of different regions into consideration
  • Regions close to the center of images have higher probability to be accessed
  • Should we reduce counts of regions close to the center when generating heatmaps?
  • It might reveal interesting insights...
Thank you!