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Kyoto University

Visualizing which Parts of IIIF Images are Looked by Users

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2018 IIIF Conference, Washington DC, US

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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}

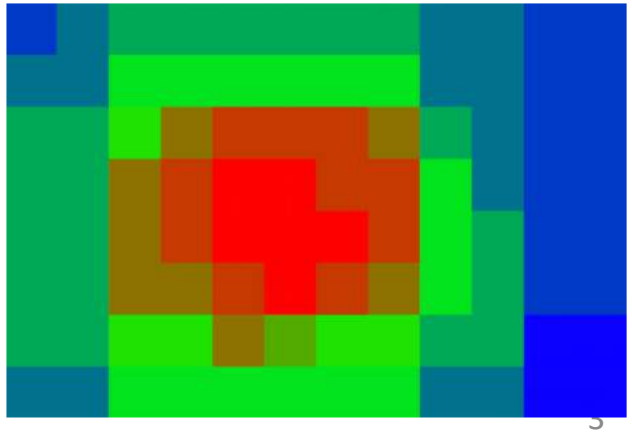
IIIF enables more fine-grained analysis of usage of images

Generating Heatmaps

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

Python Script

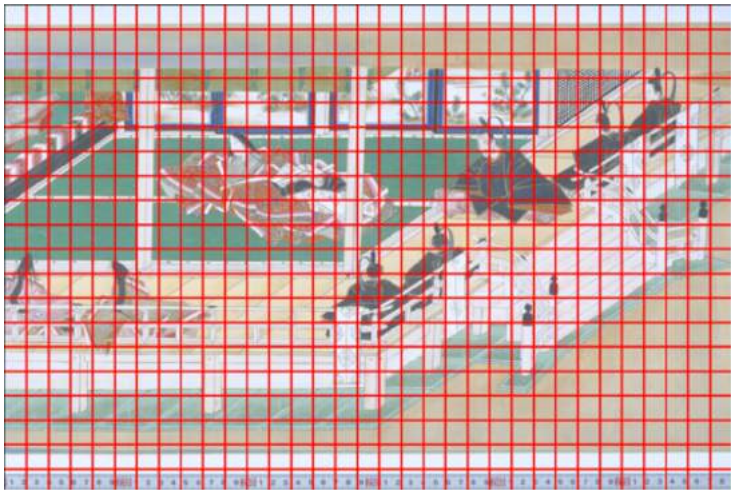
- Prepare H × W matrices for each image
  - H: height of an image, W: width of an image
  - Each element in matrices corresponds to each pixel
  - The size of images is retrieved from info.json
- Count the number of accesses to each pixel and record it to H * W matrix
- Generate heatmaps
  - Calculate RGB values for values in matrices
  - Output matrices as images



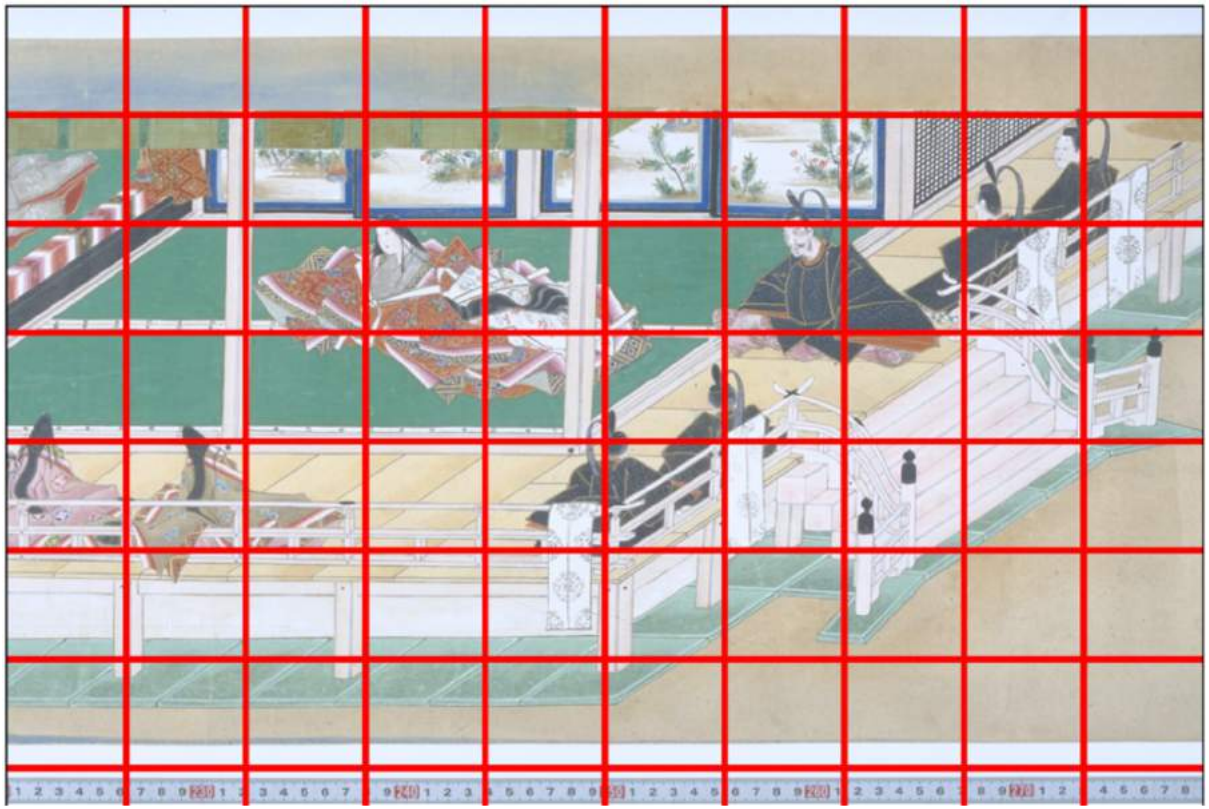
Photograph courtesy of the Main Library, Kyoto University - Tamamo-no-mae, adapted

Speed Up

Count the number of accesses to each pixel



Count the number of accesses in N-pixel unit

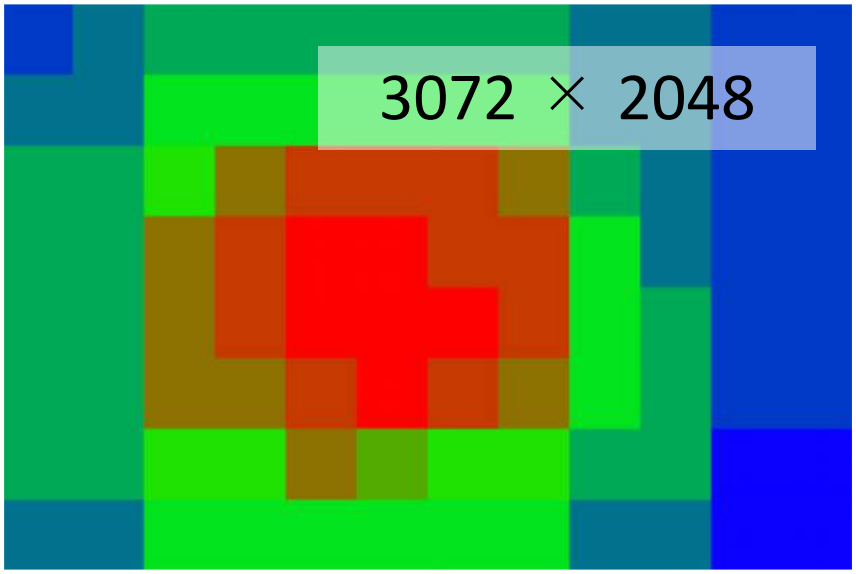


Computation time for counting # of accesses (100k access logs, in which 27,736 logs are calls of IIIF image API)
10-pixel unit: 84.23 (s)
100 pixel unit: 1.09 (s)

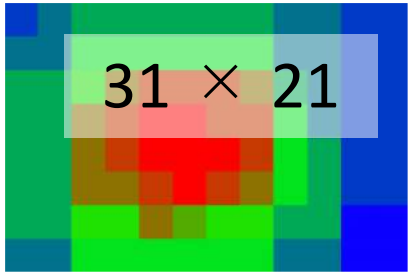
Computer used for the experiment: iMac (macOS High Sierra version 10.13.4), Processor 4GHz Intel Core i7, Memory 16GB, 1867 MHz DDR3

Speed Up Further

Output a heatmap with the size of an original IIIF image



Output in a small size



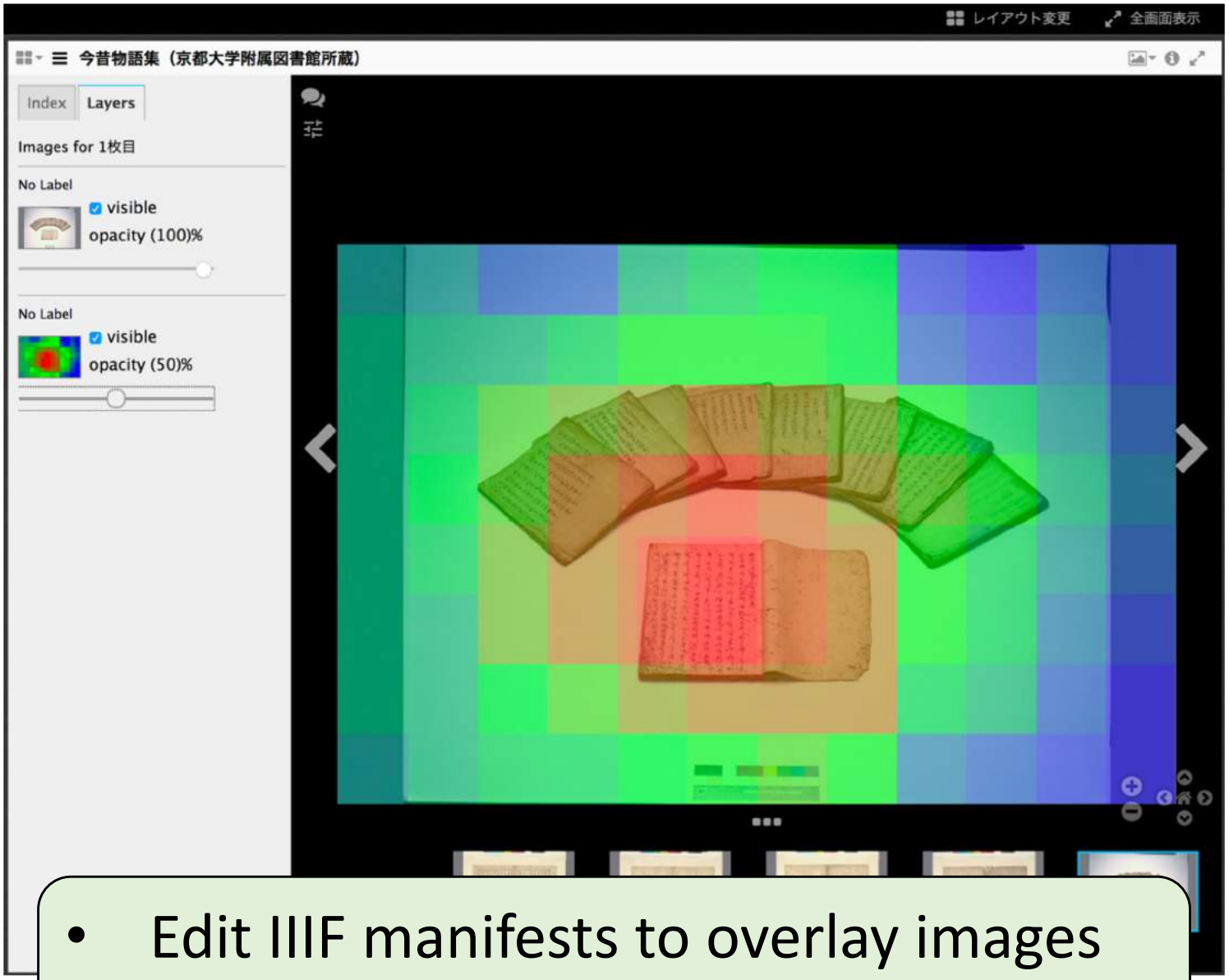
Average computation time for generating one heatmaps (calculating RGB value for each pixel and output as an image)

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

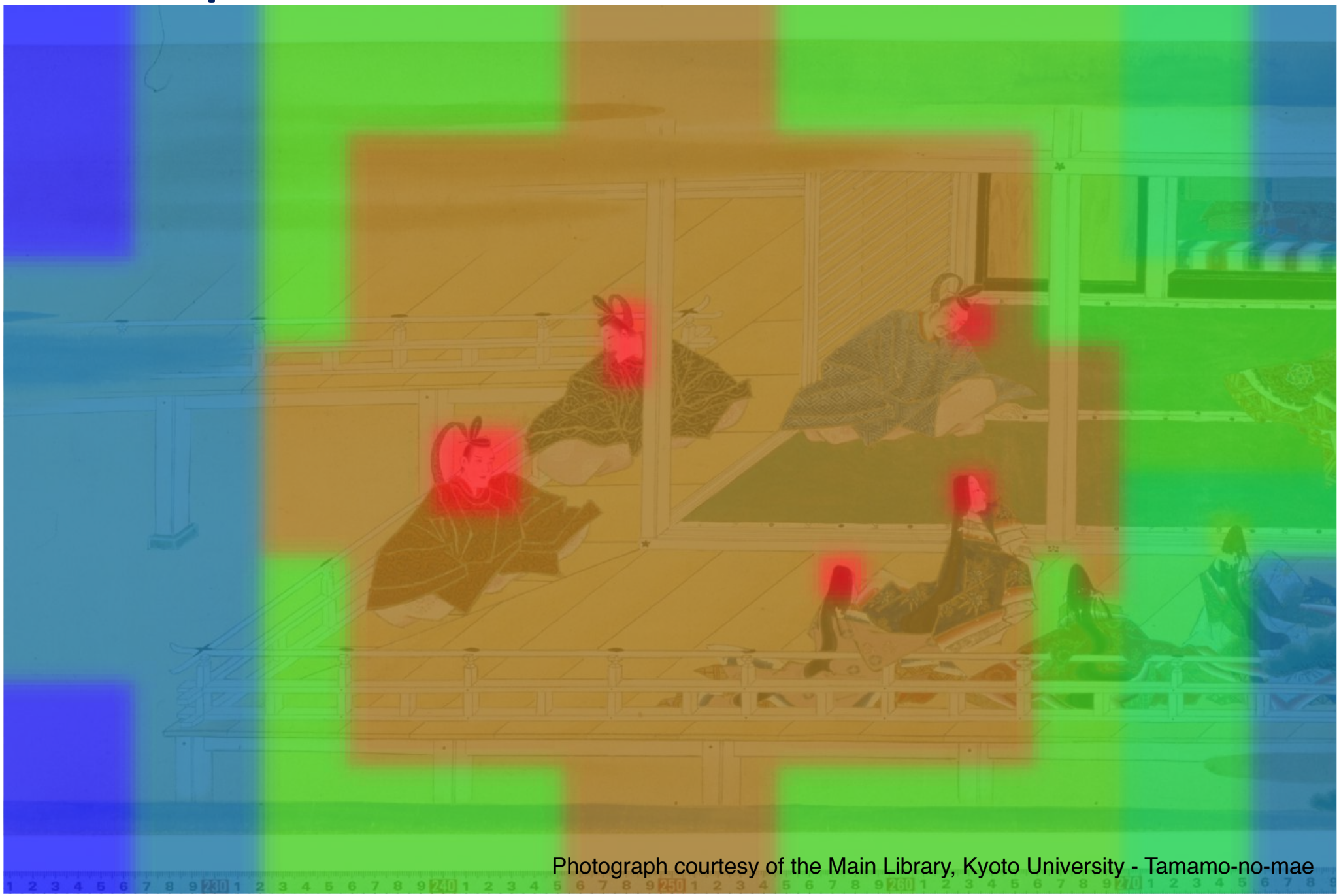


- Edit IIIF manifests to overlay images
- Use Mirador’s layer function

Example

Photograph courtesy of the Main Library, Kyoto University - Tamamo-no-mae

Example



Photograph courtesy of the Main Library, Kyoto University - Tamamo-no-mae

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

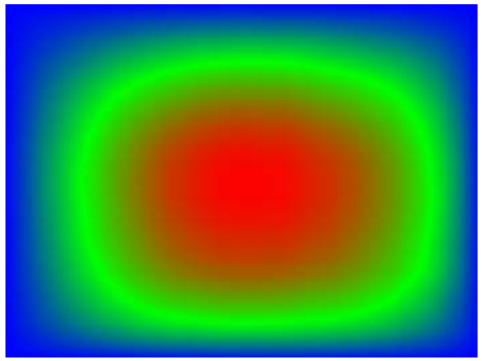
- Researchers can reflect their own research process.
- Young researchers can learn research methodology by looking how experienced researchers do their research.

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!