**A Study of Distant Viewing of Ukiyo-e Prints**

Konstantina Liagkou, John Pavlopoulos, Ewa Machotka

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**Introduction**

- This study targets multicolor landscape prints produced in Japan between the 17th and mid-19th century.
- Defined as meisho-e or ‘pictures of famous places’ these images are grounded in rich poetic culture and tend to mediate depicted places and topographies.
- Due to the richness and diversity of the corpus the extent and nature of this mediation is still not understood by art historians.
- This study hypothesizes that NLP technology allows for a large-scale digital geospatial exploration of the studied prints, which is currently impossible.
- The goal of this study is to answer the following research questions:
  - What kind of places are depicted in meisho-e prints and what places are not featured in the images?
  - How are these places distributed across Japanese territory?
- The combination of art historical ‘close reading’ with computational ‘distant viewing’, or microanalysis of images, is expected to generate a new epistemology of landscape prints.

**Methodology**

- NER to identify place-names (LOC & GPE) in inscriptions on ukiyo-e prints.
- The inscriptions on 100 prints were annotated by an art historian.
- Computed Cohen kappa for inter-annotator agreement (IAA).
- Experiments
  - SpaCy and BERT perform equally well in F1 for LOC.
  - BERT significantly better in GPE.
  - SpaCy scores high in Precision but lacks in Recall.
  - BERT balanced between Precision and Recall, with 74% F1.
- Error analysis
  - Named entities correctly identified.
  - Misclassification between GPE and LOC.
  - SpaCy and BERT perform equally well in F1 for LOC.
- Fine-tuning BERT with PLACE labels F1-score increases to 78%.
- Misclassification between GPE and LOC, maybe because LOC IAA is low.
- SpaCy and BERT perform equally well in F1 for LOC.
- Fine-tuning BERT with PLACE labels F1-score increases to 78%.
- Error analysis
  - Named entities correctly identified.
  - Misclassification between GPE and LOC.
- Future Work
  - Expand our dataset with more inscriptions, as well as with entity types.
  - Undertake a spatiotemporal study of ukiyo-e landscape prints and investigate the benefits of NLP-fuelled ‘distant viewing’ by integrating the dimension of time in our analysis.

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**Results**

**Inter-annotator Agreement (IAA)**

- Micro-averaged Cohen’s kappa: 0.79% for LOC.
- 78.63% for GPE.
- LOC + GPE → PLACE leads to 78.80% IAA.

**Experiments**

- SpaCy and BERT perform equally well in F1 for LOC.
- BERT significantly better in GPE.
- SpaCy scores high in Precision but lacks in Recall.
- BERT balanced between Precision and Recall, with 74% F1.

**Error analysis**

- Named entities correctly identified.
- Misclassification between GPE and LOC.
- Fine-tuning BERT with PLACE labels F1-score increases to 78%.

**Discussion**

- Presented a dataset (is released for public use) of ukiyo-e landscape prints, with place-names included in the print inscriptions annotated by an art historian.
- Japanese BERT-based NER model can achieve a promising performance.
- Use-case of how can a distant viewing of a visual dataset be undertaken for facilitating research in art history.

**Limitations**

- BERT NER model, fine-tuned on our dataset, can provide a means for ‘distant viewing’. However, the model makes mistakes (e.g., places that belong outside Japan).
- Only a single place-name tag, PLACE, was used in BERT NER model.
- The dataset comprises only 200 instances, but more annotations can lead to more accurate models.

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**Conclusion**

- Expanding our dataset with more inscriptions, as well as with entity types.
- Undertaking a spatiotemporal study of ukiyo-e landscape prints and investigating the benefits of NLP-fuelled ‘distant viewing’ by integrating the dimension of time in our analysis.

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**Table: Evaluation of SpaCy and BERT NER with Precision, Recall and F1-score at the named entity level, on 100 instances. In bold is the best F1-score.**

<table>
<thead>
<tr>
<th></th>
<th>SpaCy</th>
<th>BERT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1-score</td>
<td></td>
<td></td>
</tr>
</tbody>
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</tr>
<tr>
<td>Recall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F1-score</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Table: Dataset statistics that count of a number of dimensions.**

<table>
<thead>
<tr>
<th>Character</th>
<th>Avg</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GPE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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**Figures:**

- Figure 1: Image from the print series ‘The Fifty-three Stations of the Tokaido Road’. (Osaka Prefectural Museum and Art Gallery). This is a part of the dataset. figure 2: Image from the print series ‘The Fifty-three Stations of the Tokaido Road’. (Osaka Prefectural Museum and Art Gallery). This is a part of the dataset.

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**Figure:**

- A Study of Distant Viewing of Ukiyo-e Prints

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**Table: Inscriptions on prints are in 'cartouches' or are positioned directly in compositional space of the image.**

<table>
<thead>
<tr>
<th>Entity Type</th>
<th>Precision</th>
<th>Recall</th>
<th>F1-score</th>
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</thead>
<tbody>
<tr>
<td>LOC</td>
<td>0.84</td>
<td>0.73</td>
<td>0.74</td>
</tr>
<tr>
<td>GPE</td>
<td>0.59</td>
<td>0.50</td>
<td>0.54</td>
</tr>
</tbody>
</table>

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**Table: WordPiece tokens per title, number of LOC tags per title, number of GPE tags per title, number of cartouche tags per title, number of character tokens per title.**

<table>
<thead>
<tr>
<th>Character</th>
<th>Avg</th>
<th>Min</th>
<th>Max</th>
<th>WordPiece length per title</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOC</td>
<td></td>
<td></td>
<td></td>
<td>17.17</td>
</tr>
<tr>
<td>GPE</td>
<td></td>
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<td></td>
<td>6.54</td>
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<tr>
<td>Cartouche</td>
<td></td>
<td></td>
<td></td>
<td>1.52</td>
</tr>
</tbody>
</table>

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**Future Work**

- Expand our dataset with more inscriptions, as well as with entity types.
- Undertake a spatiotemporal study of ukiyo-e landscape prints and investigate the benefits of NLP-fuelled ‘distant viewing’ by integrating the dimension of time in our analysis.