Language and Image: $T^3 = \text{Text, Tags, Trust}$

Judith L. Klavans [1], Susan Chun[2], Jennifer Golbeck[1], Dagobert Soergel[1], Robert Stein[3], Ed Bachta[3], Rebecca LaPlante[1], Carolyn Sheffield[1], Kate Mayo [1], John Kleint[1], Hyoungtae Cho[1]

[1] University of Maryland, College Park;
[2] Independent Museum Consultant, NY;
[3] Indianapolis Museum of Art

Research Funded by the Institute for Museum and Library Science – IMLS
Words and Images

1. Catalogers
2. Art Historians
3. Viewers

• Trust relationships between people
<table>
<thead>
<tr>
<th>Main Entry: Category or Artist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt (New Kingdom)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Title or Description</th>
</tr>
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<tbody>
<tr>
<td><strong>Queen Nefertiti</strong>: (front view), ca. 1350 B.C. [Dynasty XVIII]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>[Location] • AICT Photo ID #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aegyptisches Museum, Berlin</td>
</tr>
<tr>
<td>#EN010</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Text References</th>
</tr>
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<tbody>
<tr>
<td>Adams 3: pl. 5.22 [alt.]</td>
</tr>
</tbody>
</table>
2. Art Historians

Nefertiti

Gardner (v. 11, pl. 3-33)

The famous painted limestone bust of Akhenaton’s queen, Nefertiti (fig. 3-33), exhibits a similar expression of entranced musing and an almost mannered sensitivity and delicacy of curving contour. The piece was found in the workshop of the queen’s official sculptor, Thutmose, and is a deliberately unfinished model very likely by the master’s own hand. The left eye socket still lacks the inlaid eyeball, making the portrait a kind of before-and-after demonstration piece. With this elegant bust, Thutmose may have been alluding to a heavy flower on its slender stalk by exaggerating the weight of the crowned head and the length of the almost serpentine neck...
3. Viewers

Bust of a woman
One eye
Big hat
Smooth skin
Egypt
Fantastic necklace
Funny looking ears
Rust-colored ribbon on headdress
Snakes on head piece
Elegant
Incroyable jeunesse
Delicat
Images and Words

An image can never be captured in words

BUT

Words are what we use to describe, catalog, and search.
Language and Image:

$$T^3 = \text{T}ext, \text{T}ags, \text{T}rust$$
Computational Linguistics for Metadata Building (CLiMB) – a metadata extraction tool for mining scholarly texts for terms describing works of art

Steve.Museum – a software development and research project, developing tools for collecting and processing social tags for enriching catalog records with input from visitors to museums, libraries, archives, and other cultural heritage sites

Trust: a method of computing interpersonal trust given metadata sources (based on FilmTrust)
Improving subject access to images by applying text mining to scholarly publications for metadata extraction.
The Problem:
Insufficient Subject Access to Images

To download image:

Mac: hold down option and click photo size.
Pc: hold down command and click desired image size.

x250 pixels
or
x512 pixels

Main Entry: Category or Artist

Egypt (New Kingdom)

Title or Description

Queen Nefertiti: (front view), ca. 1350 B.C. [Dynasty XVIII]

[Location] • AICT Photo ID #

Aegyptisches Museum, Berlin
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Text References

Adams 3: pl. 5.22 [alt.]
Adams 4: pl. 5.22 [alt.]
Adams AAT: pl. 4.42 [alt.]
Adams AAT2: pl. 3.38 [alt.]
Gardner 11: pl. 3-33
Gardner 12: pl. 3-33
Hartt 4: pl. 3-42
H&F 4: pl. 3.16 [alt.]
H&F 5: pl. 3.16 [alt.]
Janson 5: pl. 82 [alt.]
Janson 5 R: pl. 79
Janson 6: pl. 2-28 [alt.]
Stokstad: pl. 3-38
Stokstad R: pl. 3-38
Stokstad 2: pl. 3-38
The famous painted limestone bust of Akhenaton’s queen, Nefertiti (fig. 3-33), exhibits a similar expression of entranced musing and an almost mannered sensitivity and delicacy of curving contour. The piece was found in the workshop of the queen’s official sculptor, Thutmose, and is a deliberately unfinished model very likely by the master’s own hand. The left eye socket still lacks the inlaid eyeball, making the portrait a kind of before-and-after demonstration piece. With this elegant bust, Thutmose may have been alluding to a heavy flower on its slender stalk by exaggerating the weight of the crowned head and the length of the almost serpentine neck...
Tags: The Essence of Steve

Exploring the role of tagging and the relationship of the resulting folksonomy to professionally created museum documentation.
Don Loper, 0 Loper, 1906-1972
Woman's Evening Dress and Coat, circa 1958
Silk faille; 1) Center back of dress: 64 1/2 in. (163.7 cm); 2) Center back of coat: 47 1/2 in. (120.6 cm)
Gift of Mrs. Susan Quinn Keck, AC1983.121.1.1-2
Los Angeles County Museum of Art

Tags for this work:
Cape, Gloves, Red, balloon sleeves, black, black velvet dress, blouson sleeve cape, bracelet, elegant, empire waist, evening, fashion, formal dress, formal silk cape, full length gloves, mannequin, opera, pointy slippers, red cape, style
Don Loper, 1906-1972

Women’s Evening Dress and Coat, circa 1958

Silk faille;

1) Center back of dress: 64 ½ in. (163.7 cm);

2) Center back of coat: 47 ½ in. (120.6 cm)

Gift of Mrs. Susan Quinn Keck, AC1993.121.1.1-2

Los Angeles Museum of Art
cape
gloves
red
balloon sleeves
black
black velvet dress
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bracelet
elegant
empire waist
evening
fashion
formal dress
formal silk cape
full length gloves
mannequin
opera
pointy slippers
red cape
style
Did Tag Match Museum Documentation?

- Did Not Match
- Matched

14% Did Not Match
86% Matched
Challenge:
Many terms were found more than once in Art and Architecture Thesaurus. How do you disambiguate terms without context?
Challenges:
Many of the matches in the Union List of Artist Names were ambiguous.

In full string matches, the tag ‘adam’ would match any entry that included the name ‘adam’.
Review of Steve Results

Are Tags Useful?

- 88% Useful
- 12% Not Useful
Steve.Museum - Key findings

• **Gaps**: 86% of tags were not found in museum documentation

• **Usefulness**: 88% of tags were assessed as *useful for searching* by museum staff

• **Correlations**: Tags applied 2 or more times were “94%” considered useful

• **Challenges**: ambiguity and synonymy
Trust: The Essence of Trust

Inferring trust between users to generate user similarity values for image descriptions to assist with image access.
A Clockwork Orange (1971)

User Options

Your Rating: 

I read the book before seeing the movie, and the book had a point ...

Update

Ratings of A Clockwork Orange (1971)

Number of Ratings 266
Average User Rating ★★★
Your Recommended Rating ★★
Your Rating ★★

Reviews of A Clockwork Orange (1971)
I read the book before seeing the movie, and the book had a point. There was a deep social commentary there, amidst the violence and torture. The movie, however, lost much of the meaning of the book. The violence was not justified by the plot, and the message was left very shallow.

A lot of people who love this movie love it because they know it is supposed
Stage 2: Profile 32
(of at most 54)

Person 32

How much do you trust Person 32's opinions about movies?

If there are any specific reasons you gave this person the rating you did, please enter them here:

<table>
<thead>
<tr>
<th>Movie Name</th>
<th>Average Rating</th>
<th>Your Rating</th>
<th>Person 32's Rating</th>
<th>Difference Between Your Rating and Person 32's Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Usual Suspects (1995)</td>
<td>8.7</td>
<td>10</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Titanic (1997)</td>
<td>6.9</td>
<td>2</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Catch Me If You Can (2002)</td>
<td>7.6</td>
<td>9</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Twister (1996)</td>
<td>5.9</td>
<td>5</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Back to the Future (1985)</td>
<td>8.1</td>
<td>6</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>Grease (1978)</td>
<td>6.8</td>
<td>7</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>Armageddon (1998)</td>
<td>5.7</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Gigli (2003)</td>
<td>2.3</td>
<td>1</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Toy Story 2 (1999)</td>
<td>8.1</td>
<td>7</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>The Maltese Falcon (1941)</td>
<td>8.4</td>
<td>8</td>
<td>9</td>
<td>1</td>
</tr>
</tbody>
</table>
Validation

• Gather all pairs of FilmTrust users who have a known trust relationship and share movies in common
  – 322 total user pairs

• Develop a formula to estimate trust

• Compute accuracy by comparing computed trust value with known value
In FilmTrust

Use weights \((w_1, w_2, w_3, w_4, w_5) = (7,2,1,8,2)\)

\[
t_{ij} = \min \left( 10, \frac{w_1 \Theta_{ij}}{w_4 \Theta_{ij}} + \frac{w_2 \nabla_{ij}}{w_4 \Theta_{ij}} + \frac{w_3 \Theta_{\chi,ij}}{w_4 \Theta_{ij}} + (\tau_i - \tau) \right)
\]

If \(\Theta_{\chi}\) exists, otherwise.

<table>
<thead>
<tr>
<th></th>
<th>Overall Similarity Only</th>
<th>Our Formula</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlation</td>
<td>0.24</td>
<td>0.73</td>
</tr>
<tr>
<td>Absolute Mean Error</td>
<td>1.91</td>
<td>1.13</td>
</tr>
<tr>
<td>Std. Dev of Mean Error</td>
<td>1.95</td>
<td>0.95</td>
</tr>
</tbody>
</table>
FilmTrust - Key Findings

- Trust as a weight in recommender systems.
- Trust outperformed overall similarity in some cases.
- Suggests that trust captures something more than overall similarity.
Language and Image: $T^3 = \text{Text, Tags, Trust}$

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Core Research Questions

• What is the relationship between tags and terms derived from text?

• What types of guidance in tagging are acceptable to what type of users?

• Does guidance lead to “better” tagging?

• How can tags be used to contribute to disambiguation and vice versa?
Core Research Questions

• How to compute trust between people from their tags?

• Can clustering trust scores lead to an understanding of users?

• How can trust be applied to documents?

• How do lexical features affect trust, disambiguation, clustering, and search/retrieval?
Current Activities

1. Analyze tags from steve with CL tools
2. Experiments on trust in the T3 setting
3. Consideration of tag cloud for ambiguity
4. Review of a guided tagging environment
1. Tag Analysis- Stemming

- Porter Stemmer (nltk.stem.PorterStemmer.stem)
  - Could: Find the same morphologically related words with different part of speech tags or those that are capitalized
    - Example: different, differ, difference -> differ;
      teaching -> teach;
      Rain, Rains -> Rain
  - Could not: Show a stemmed word in dictionary form or deal with irregular verbs or irregular plural nouns
    - Example: Jesus -> Jesu;
    - capital -> capi;
    - taught -> taught;
    - data -> data
1. Tag Analysis - Morphology

• Wordnet Morphy Stemmer (nltk.corpus.wordnet.morphy)
  – Could: Correctly find a ‘root verb’ or a singular noun
    • taught -> teach; data -> datum
  – A few errors:
    • teachings -> teaching -> teaching
  – Useful for misspellings?
    • vrouw -> None
• **Input**: 49k steve terms - mixed case

• **Output**
  - lowercase letters: 44,000, 12,500 distinct words
  - with caps: 5,000 words, 3,000 distinct words (freq: 1.75/word)
  - with a question mark: 223 words, 205 distinct words (freq: 1.09/word)
  - with a exclamation point: 22 words, 22 distinct words (freq: 1.00/word)
  - with a word with 'I': 12 words, 12 distinct words (freq: 1.00/word)

• **Error Rate**
  - Estimate an error rate of less than 4%
Foreign and Misspelled Tags

- other languages: 5-10%
  - Example: shawabti
- non-alphabetical words: approximately 0.6%

- In a sample group of 12 works, the steve project found that 5.4% of the tags were in foreign languages.
• Who is reading the newspaper?

• I want this print!

• My 4 yr old kid could do better!
Current Activities

1. Analyze tags from steve with CL tools
   - Morphology and thesaural matches
   - Tag types

2. Experiments on trust in the T3 setting

3. Consideration of tag cloud for ambiguity

4. Review of a guided tagging environment
Images and Tags

Content: river, mountains

Color: brown, yellow

Emotion: exciting, intense

Period: late 19th century

Other: reminds me of my summers in Montana
With its powerful imagery, striking color scheme, and bold patterns, *Vorhor, The Green Wave* is a vivid expression of a pervasive shift in attitude experienced by many progressive painters in late 19th-century France. The artist's right to reinterpret-rather than imitate-nature became a guiding principle of Paul Gauguin and his followers. When Georges Lacombe encountered them in 1892, he rapidly adopted their independent outlook and decorative impulse.

Indianapolis Museum of Art: Highlights of the Collection (2005)
Steve Tag Analysis

Vorhor, *The Green Wave*, George Lacombe

... Fascinated by the sea, the young artist from Versailles summered in the region, and from 1893 to 1897 he produced a series of coastal views that are his most innovative paintings.... He also exaggerated his *colors*, choosing brilliant tints of turquoise, mauve, and *gold*. Familiar with Japanese prints, Lacombe borrowed their use of flattened perspective and the practice of treating waves as decorative patterns...

Indianapolis Museum of Art: Highlights of the Collection (2005)
Steve Tag Analysis

Tags assigned:

cliffs, ocean, yellow, sunset, rushing water, waves, clouds, Water, Mountains, Landscape, Seascape, tempest, waves, surge, water, cavernous, cliffs, hydraulic, yellow, brown, surf, waves, water, powerful, painting, contemporary, river view, ocean, painting, ocean, Seascape, rocky, churning surf, sharp, clouds, perspective, opalescence, opalescence, frothy, motion, rush, fill, wave, flow, current, yellow sea, pastel water, trepidation, surging water, color, perspective, profiles in cliffs, peacock feathers in wave in fo, peacock feathers in wave, Japanese influence, Gauguin influence
Steve Tag Analysis

Subset of AAT results from a search on ‘gold’:

- **gold (metal)** (<gold and gold alloy>, nonferrous metal, ... Materials) [300011021]
  Gold (metal)

- **gold (color)** (<variable yellow colors>, <yellow colors>, ... Color) [300311191]
  gold color
Steve Tag Analysis

- **gold (color)** (<variable yellow colors>, <yellow colors>, ...
  Color) [300311191]

- **gold color**

  “yellow” and “color” help identify the appropriate sense of the “gold”
Current Activities

1. Analyze tags from steve with CL tools
   - Morphology and thesaural matches
   - Tag types
2. Experiments on trust in the T3 setting
3. Consideration of tag cloud for ambiguity
4. Review of a guided tagging environment
Galatea of the Spheres (1952)
Salvador Dali
Rate the quality of and your trust in each set of tags:

Galatea of the Spheres (1952)
Salvador Dali

spheres, beautiful woman, sky, brunette

Quality (1-10): 9
Trust (1-10): 4

Assompta corpuscularia lapislazulina, Carmelite Studies, Dali, Dalis desire, Father Bruno, Galatea, God, Paranoiac-Critical Study, Raphael, Raphaellesque Head Exploding, Raphael's temperature, Rhinoceros Figure of Phidias Illios, Saint John, Salvador Dali, Such works. The discontinuity. Vermeer's Lacemaker, a few...
Research Questions on Trust

• How do users relate to one another in web-based social networks?
• How can we estimate relationships (like trust) between people who do not know each other?
• How do social connections, like trust, relate to information?
• How can we use trust to build intelligent systems to improve information access?
Instructions
Start tagging by entering terms into the General box. Press enter after each entry; tags will be added automatically to the categories below. If you feel a tag belongs to a different category, simply drag and drop it into the correct box. You may also apply tags by entering them directly into the category boxes. See the Help section for more information on applying tags.

General
- surrealism
- peaceful
- blue

Image Content
- woman
- blue

Style
- surrealism

Facet

Interpretation
- peaceful
DH June 2009

B. Ragger, 2009

Dali, 1904-1989

The Persistence of the Spheres, 1952

Museu Dali

Surrealism

Peaceful

Blue

Disambiguation and Spelling Pop-up

Image Class

Woman

Select

1. [n] blue, blueness (blue color or pigment; resembling the color of the clear sky in the daytime) "he had eyes of bright blue"

Style

Surrealist

Select

3. [adj] gloomy, grim, blue, depressed, dispirited, downcast, downhearted, down in the mouth, low, low-spirited (filled with melancholy and despondency) "gloomy at the thought of what he had to face"; "gloomy predictions"; "a
DH June 2009
Any questions?