Trick or Treat: Thematic Reinforcement for Artistic Typography

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Motivation

- Convey abstract concepts
- Express rich emotions
- Reinforce messages

Google Doodle

Advertising

Retail

Logo Design
Task

Word: exam  Theme: education

Thematic Reinforcement for Artistic Typography
Challenges: Human

Domain-specific knowledge for identification of relevant cliparts

Ability to visualize a letter in a clipart

Choosing the best clipart for a letter in terms of matching and relevance score

Theme: “corporate”

Theme: “politics”

Word: “flax”
Theme: “food”
Challenges: Technical

Training
Lack of large-scale text-graphic paired datasets in domains of interest

Evaluation
Subjectivity and inter-human disagreement

Word: “box”
Theme: “craft”
Outline

Approach
- Data
- Model
- Finding Matches

Evaluation
- Word Theme Collection
- Learnt Representation
- Effect of dataset
- Quality of TReATs

Future Work
- Drawbacks
- Interactive Interface
Outline

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Data

The Noun Project

- Binary images (black & white)
- Downloaded 50K images
- 200 x 200 → 240 x 240

Cliparts

OTF & TTF files

- Sifting
- 777 distinct fonts ~40.4K images
- 240 x 240

Fonts
L_{\text{reconstruct}}
Ensures that letters and clipart that are close in the latent space also look similar in the image space

Final Loss
\[ \mathcal{L} = \alpha \mathcal{L}_{\text{reconstruct}} + (1 - \alpha) \mathcal{L}_{\text{classify}} \]

\[ \mathcal{L}_{\text{reconstruct}} = \frac{1}{|X_{cl}|} \sum_{i \in X_{cl}} \text{SSD}(X_i, \hat{X}_i) \]

\[ \mathcal{L}_{\text{classify}} = -\frac{1}{|X_i|} \sum_{i \in X_i} \log P_t(Y_i) \]

\[ P_t(\cdot) = \text{softmax}(WZ_i + b) \]

L_{\text{classify}}
Ensures that the latent space is informed by discriminative features that make one letter different from the other

We have labels!

'upper_n'
Input

Noun Project
2 million icons

Theme-specific
7000 icons

Trained Model

W = \{Z_E, Z_X, Z_A, Z_M\}

T = \{Z_{c1}, Z_{c2}, ..., Z_{c7000}\}

Cosine Similarity

W \times T
Qualitative Results

Word: book  Theme: library

Word: car  Theme: driving, road, signs

Word: witch  Theme: Halloween

Word: play  Theme: Olympics
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Evaluation: Learnt Representation

`t-Distributed Stochastic Neighbor Embedding (tSNE)`
Evaluation: Effect of Dataset

![Graphs showing the effect of different datasets on classification results.](image-url)
Word-Theme Collection

Instructions: Given a word and an associated theme, we have a bot that can draw a doodle. See some examples below.

- Each participant asked for 5 pairs
- 21 unique participants
- 104 word-theme pairs

<table>
<thead>
<tr>
<th>Word</th>
<th>Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exam</td>
<td>Education, School, Learning</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Word</th>
<th>Theme</th>
</tr>
</thead>
</table>
Evaluation: Quality of TReATs

Word: Hurricane
Theme: Weather, Disaster
Evaluation: Word Detection

Instructions:

1. What word is represented in the doodle? Note that the number of letters in the word should match the number of cliparts in the doodle.
2. Enter the word in the textbox provided. This task is not case-sensitive.
3. Note that the word should be an actual English word. If the Doodle doesn't obviously look like a word, try your best.
4. Note that some doodles might contain text in regular font. Please enter the word you see.

Examples:

- 520 TReATs
- Each shown to 5 participants
- 461 unique participants

witch
Evaluation : Word Detection
Evaluation: Word Detection
Evaluation : Word Detection
Evaluation : Word Detection
Evaluation : Word Detection

CASINO
Evaluation: Word Detection

Word Accuracy

Letter Accuracy

TA | TS | NA | NS | F
Evaluation: Theme Detection

Instructions:
1. What theme does the doodle represent?
2. If you feel the doodle icons aren’t related to any of the given theme options, choose the closest theme from the options.
3. Note that some doodles might contain text in regular font. In that case, use your best judgement.

Examples:

Select the most suitable theme.
- Halloween
- Environment
- Winter
- Harry Potter

Here, the cliparts are of a haunted halloween-like theme (candlelight, skeleton, moon). Thus, the answer is Halloween.

- 520 TReATs
- Each shown to 6 participants
- 163 unique participants
Evaluation : Theme Options

Select the most suitable theme.

- home, furniture
- drinks
- corpse, undertaker, vampire
- food, dessert
- birds
- food

6 options

- 1 true theme
- 2 nearest neighbors in word2vec* space
- 3 random

*word2vec is a popular technique to generate vector representations of a word or "word embeddings" which capture the meaning of the word such that words that share common contexts in language (that is, likely have similar meaning) are located in close proximity to one another in the space.
Evaluation: Theme Options

Select the most suitable theme.
- drinks
- corpse, undertaker, vampire
- food, ingredients
- spooky, haunted, halloween
- holiday decorations
- spring, animals

6 options
- 1 true theme
- 2 nearest neighbors in word2vec* space
- 3 random

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**Evaluation : Theme Options**

Select the most suitable theme.
- food, ingredients
- food
- computer
- food, dessert
- music, melody, songs
- scare, fearful, silent, afraid

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6 options
- 1 true theme
- 2 nearest neighbors in word2vec* space
- 3 random
Evaluation : Theme Options

6 options

- 1 true theme
- 2 nearest neighbors in word2vec* space
- 3 random

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Evaluation : Theme Options

Select the most suitable theme.
- weather, disaster
- cold, white, winter
- fruit
- sky, rain, weather
- fantasy
- sports

6 options
- 1 true theme
- 2 nearest neighbors in word2vec* space
- 3 random

*word2vec is a popular technique to generate vector representations of a word or "word embeddings" which capture the meaning of the word such that words that share common contexts in language (that is, likely have similar meaning) are located in close proximity to one another in the space
Evaluation: Theme Detection

![Bar chart showing theme detection recall rates](chart.png)
Evaluation: Creativity

520 TReATs
Each shown to 5 participants
207 unique participants

This is a doodle of "microphone" in a "music" theme.

On a scale of 1-5, how much do you agree with this statement?
This doodle is creative (i.e., surprising and/or intriguing and/or fun).

Tell us in a sentence or two what you think about the doodle.
Evaluation: Creativity

This is a doodle of "sick" in a "healthcare" theme.

On a scale of 1-5, how much do you agree with this statement?
This doodle is creative (i.e., surprising and/or intriguing and/or fun).

Choose your answer:
- Strongly agree
- Somewhat agree
- Neutral
- Somewhat disagree
- Strongly disagree

Tell us in a sentence or two what you think about the doodle.
Evaluation: Creativity

This is a doodle of "trophy" in a "sports, competition" theme.

On a scale of 1-5, how much do you agree with this statement?
This doodle is creative (i.e., surprising and/or intriguing and/or fun).

Tell us in a sentence or two what you think about the doodle.
Evaluation : Creativity

This is a doodle of "wall" in a "united states" theme.

On a scale of 1-5, how much do you agree with this statement?
This doodle is creative (i.e., surprising and/or intriguing and/or fun).

Tell us in a sentence or two what you think about the doodle.
Evaluation : Creativity

This is a doodle of "butterfly" in a "spring, animals" theme.

**BUTTERFLY**

On a scale of 1-5, how much do you agree with this statement?

This doodle is creative (i.e., surprising and/or intriguing and/or fun).

- [ ] Strongly agree
- [ ] Somewhat agree
- [ ] Neutral
- [ ] Somewhat disagree
- [ ] Strongly disagree

Tell us in a sentence or two what you think about the doodle.
"cool characters and each one fits the theme of the ocean"

“Its creative and represents the theme well, but I don’t see disney all that much.”
Evaluation: Creativity

"I like how it uses the image of the US and then a state to spell out the word and looks like something you’d remember."

"Very fun and intriguing. I like how all the letters are pictures representing a computer mouse."

Word: wall
Theme: United States

Word: mouse
Theme: computer
"It is creative but it has nothing to do with fear."

Word: coward
Theme: scare, fearful, silent, afraid

"It does a very good job of spelling out CHRISTMAS, but the individual letters are not related to the holiday at all."

Word: Christmas
Theme: holiday decorations
“It is somewhat creative, especially the unicorn head for “G”, though I don’t know what any of it has to do with the theme.”

“There are too many icons that seemingly have nothing to do with the theme.”
Evaluation : Creativity

**Coward**

- Word: coward
- Theme: scare, fearful, silent, afraid

“It just spells out the word, not really a doodle.”

**Parrot**

- Word: parrot
- Theme: birds, tropical

“Its not a doodle, its just the word Parrot, so I don’t think its creative at all.”
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**Future Work**
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Future Work: Drawbacks

- No Clipart Relevance Score
- No Contextual Querying
- Imperfect Match Scores

Interactive Interface
- top-k matches
- Iteration over themes

Word: church
Theme: pastor, Jesus, people, steeple

Word: money
Theme: finance, banking, support

Word: ocean
Theme: fish, waves, boat
Demo
Summary

- **TReAT – Thematic Reinforcement for Artistic Typography**
  - A computational approach for semantic reinforcement
  - To make text visually appealing and memorable

- **Unsupervised approach**
  - Learn a latent space to represent letters and cliparts
  - Compute similarities between the two

- **Human studies**
  - Word and Theme Recognition
  - Creativity

**Code** - https://github.com/purvaten/doodling


**Demo** - http://doodle.cloudcv.org/