

Trick or : Thematic Reinforcement for Artistic Typography



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Motivation



Google Doodle



Retail

- **Convey** abstract concepts
- **Express** rich emotions
- **Reinforce** messages



Advertising



Logo Design

Task

Word : exam

Theme : education

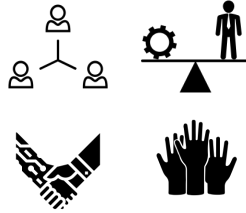


Thematic Reinforcement for Artistic Typography

Challenges: Human

Domain-specific knowledge for identification of relevant cliparts

Theme:
“corporate”



Theme:
“politics”

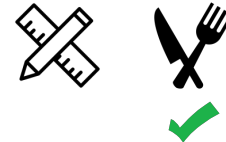


Ability to visualize a letter in a clipart



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

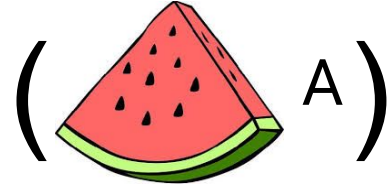
Word: “flax”
Theme: “food”



Challenges: Technical

Training

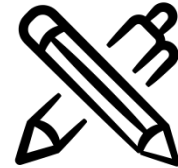
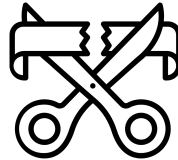
Lack of large-scale
text-graphic paired
datasets in domains of
interest



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

Approach

- Data
- Model
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Evaluation

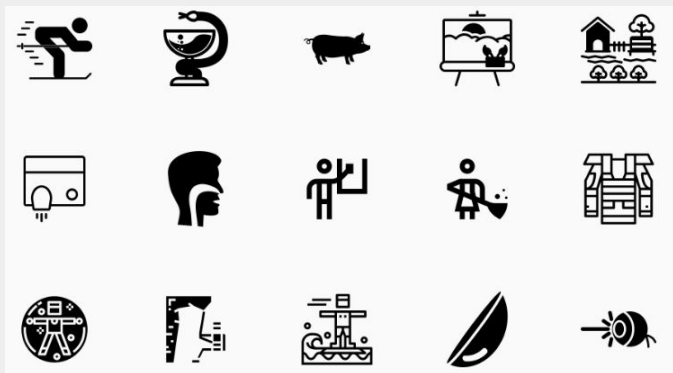
- Word Theme Collection
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Data

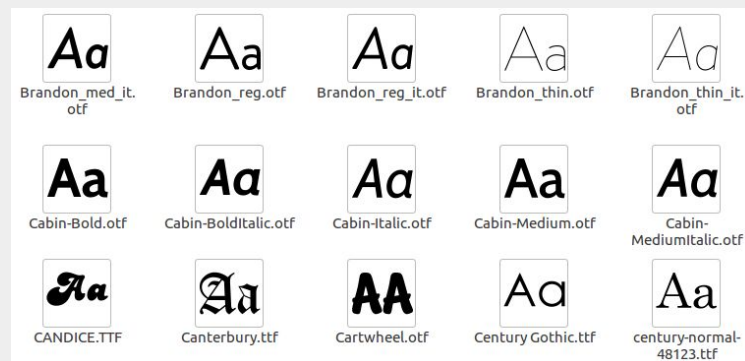
Cliparts



The Noun Project

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

Fonts



OTF & TTF files

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

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

$\mathcal{L}_{\text{reconstruct}}$

Ensures that letters and clipart that are close in the latent space also look similar in the image space

Cliparts



$\mathcal{L}_{\text{reconstruct}}$

Output image

Letters



Decoder

f_{dec}

Z_i

Letters

$\mathcal{L}_{\text{classify}}$

Ensures that the latent space is informed by discriminative features that make one letter different from the other

Final Loss

$$\mathcal{L} = \alpha \mathcal{L}_{\text{reconstruct}} + (1 - \alpha) \mathcal{L}_{\text{classify}}$$

$\mathcal{L}_{\text{classify}}$

Labels

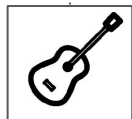
$$\mathcal{L}_{\text{classify}} = -\frac{1}{|\mathbf{X}_l|} \sum_{i \in \mathbf{X}_l} \log P_i(Y_i)$$

$$P_i(\cdot) = \text{softmax}(W Z_i + b)$$

f_{enc}

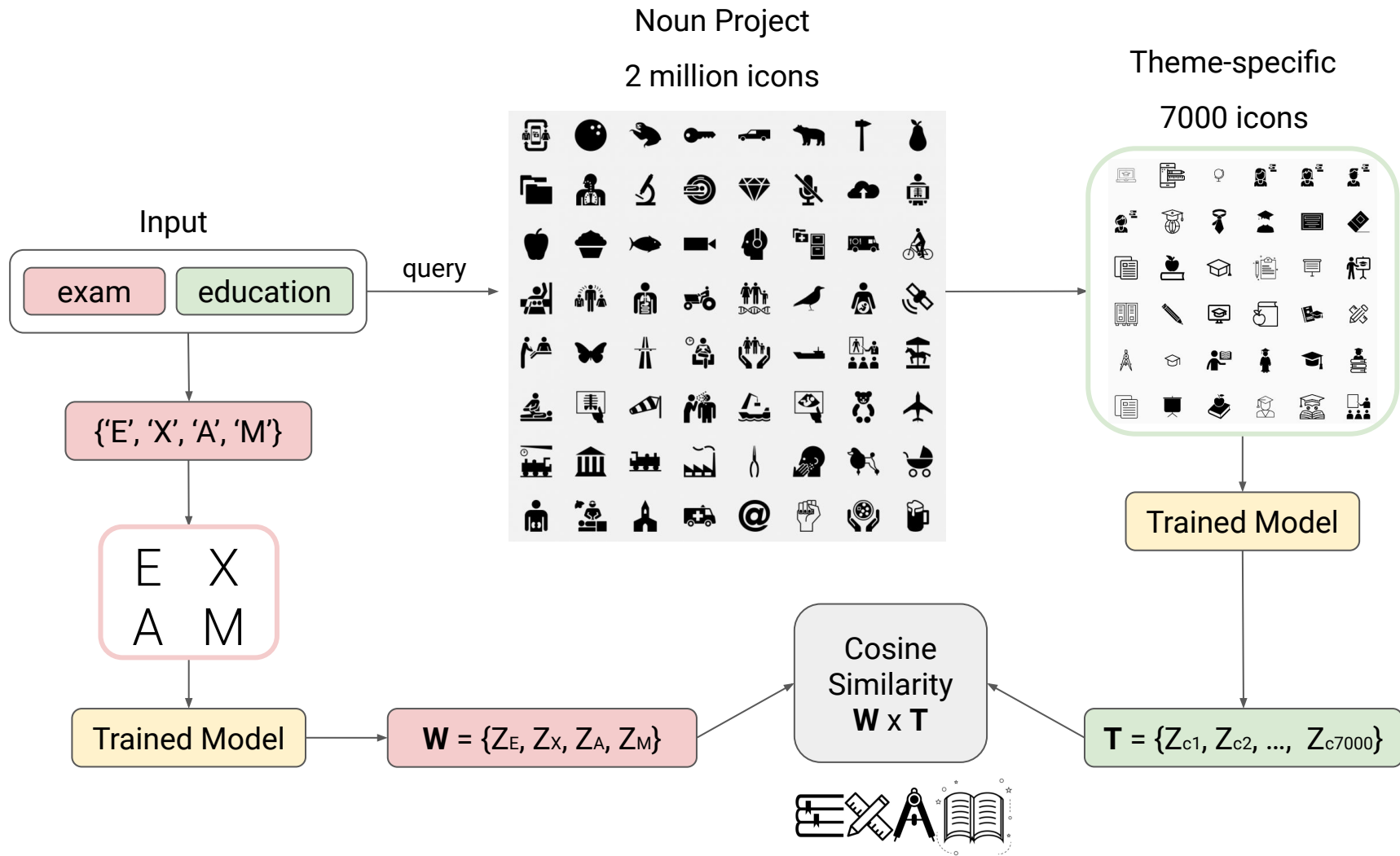
Encoder

Input image

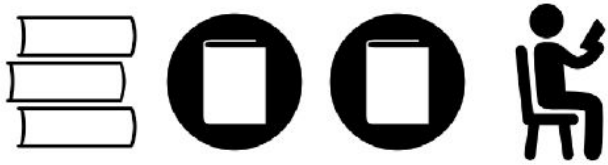


We have labels!

'upper_n'



Qualitative Results



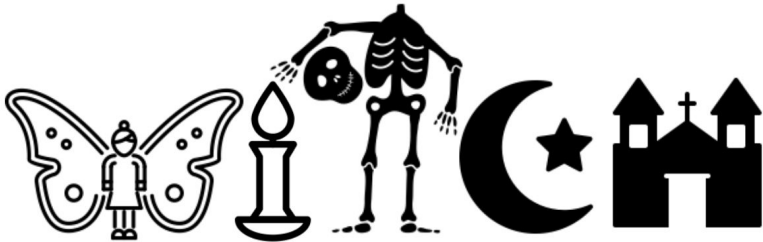
Word : book

Theme : library



Word : car

Theme : driving, road, signs



Word : witch

Theme : Halloween



Word : play

Theme : Olympics

Outline

Approach

- Data
- Model
- Finding Matches

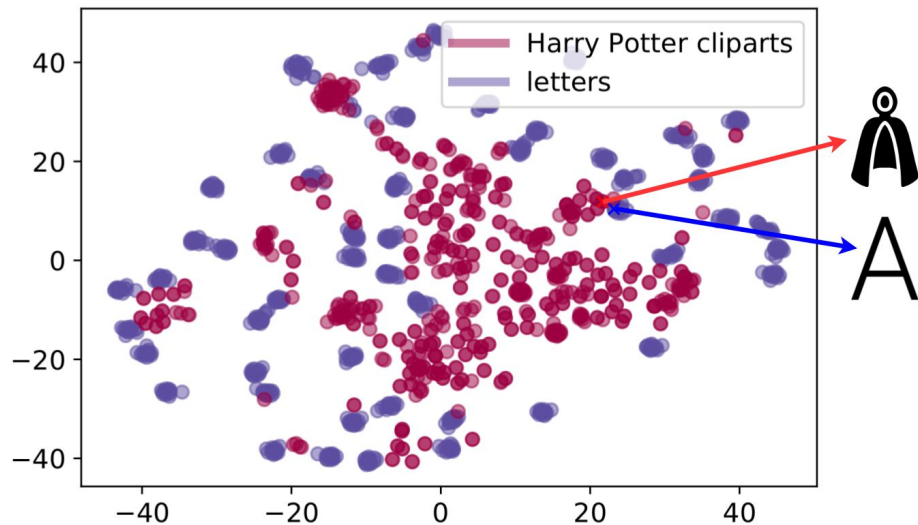
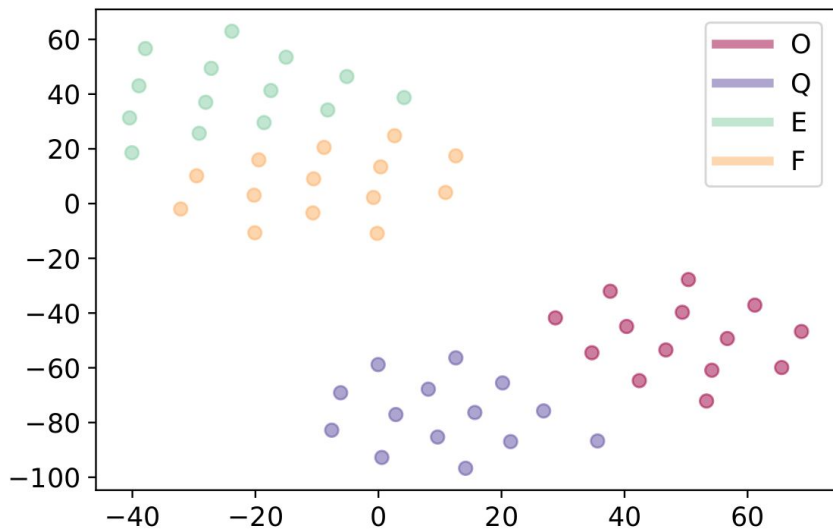
Evaluation

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

Future Work

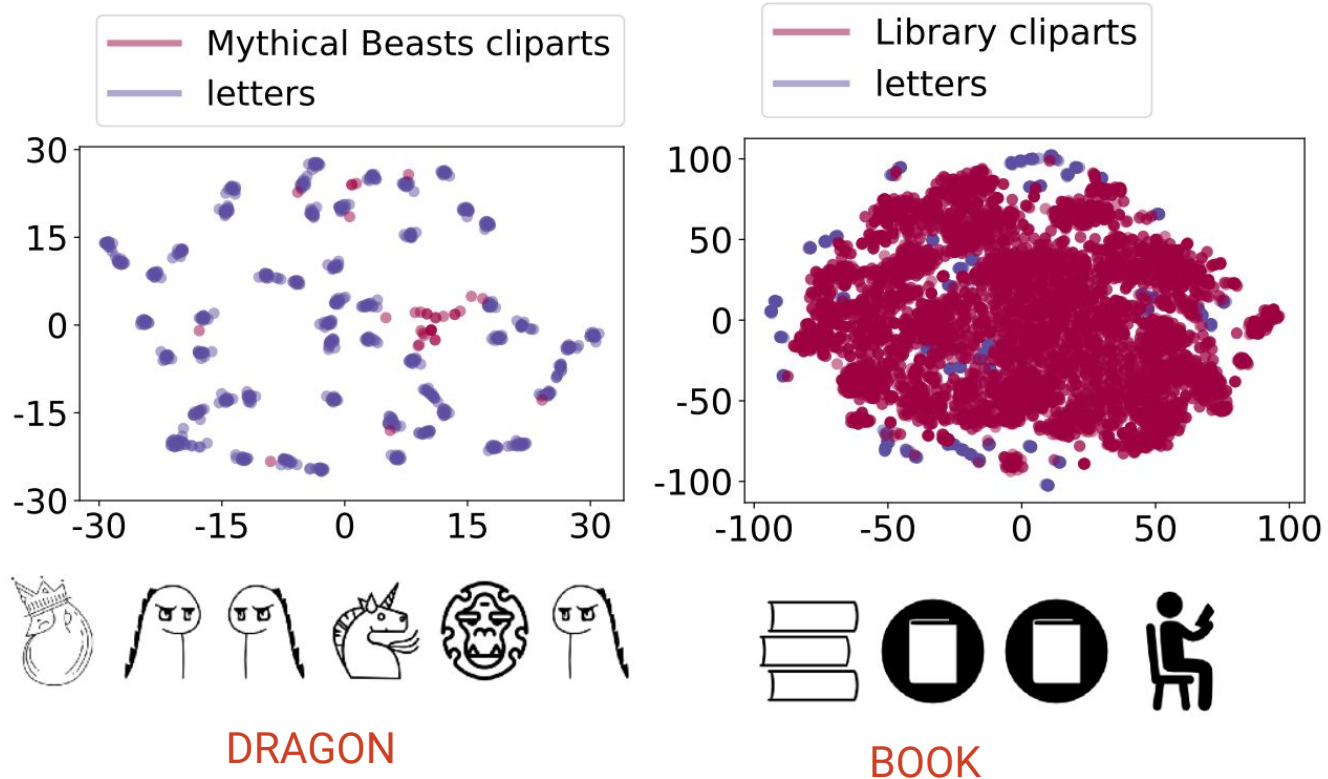
- Drawbacks
- Interactive Interface

Evaluation : Learnt Representation



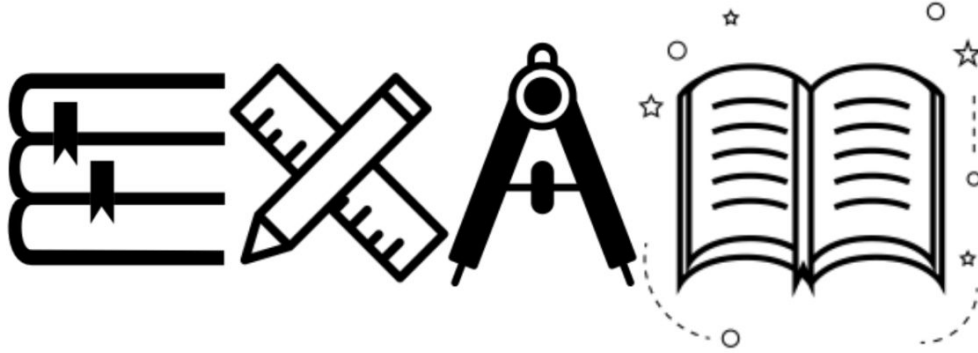
t-Distributed Stochastic Neighbor Embedding (tSNE)

Evaluation : Effect of Dataset



Word-Theme Collection

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



Word
Exam

Theme
Education, School, Learning

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

Word

Theme

Evaluation : Quality of TReATs

Word: Hurricane

Theme: Weather, Disaster



THEME-ALL



THEME-SOME



NOTHEME-ALL



NOTHEME-SOME

HURRICANE

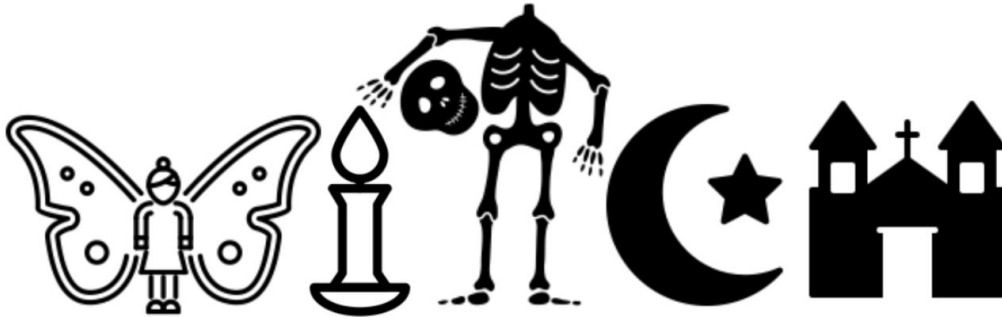
FONT

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:



witch

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

Evaluation : Word Detection

THEME-ALL



Evaluation : Word Detection

THEME-SOME



Evaluation : Word Detection

NOTHEME-ALL



Evaluation : Word Detection

NOTHEME-SOME

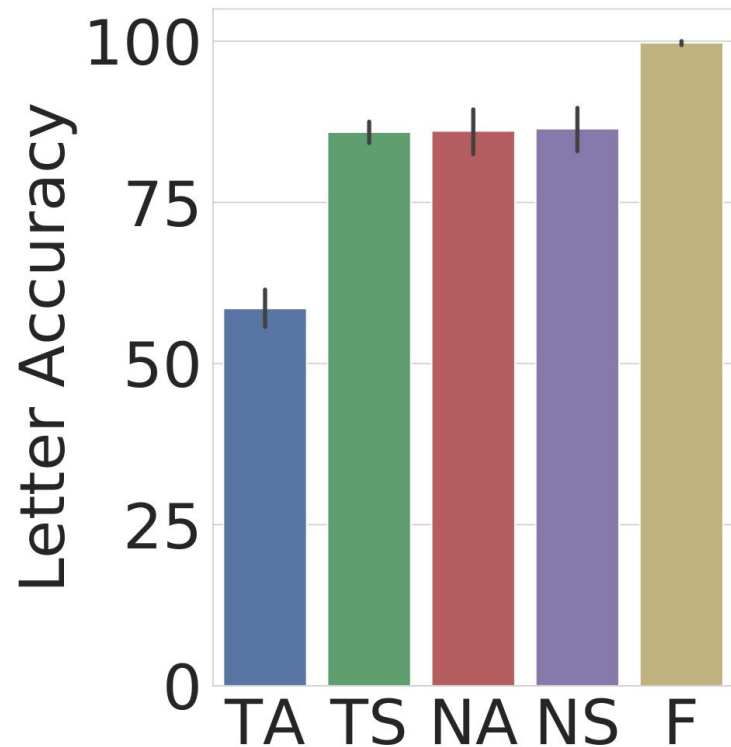
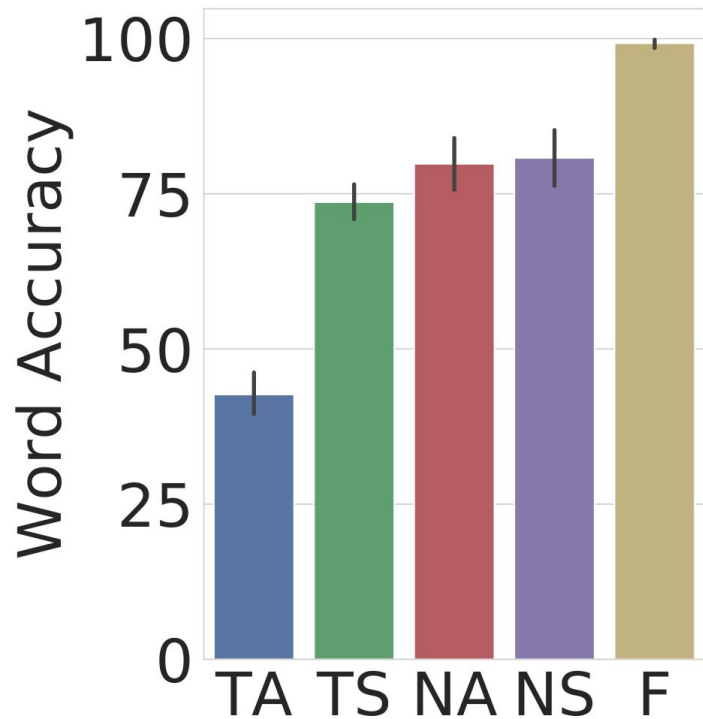


Evaluation : Word Detection

FONT

CASINO

Evaluation : Word Detection

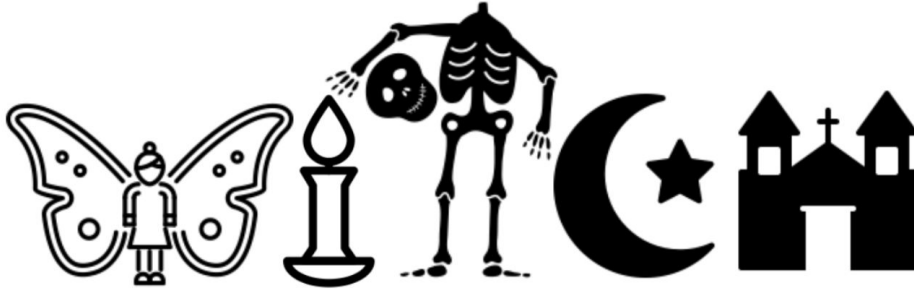


Evaluation : Theme Detection

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:



- 520 TReATs
- Each shown to 6 participants
- 163 unique participants

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**.

Evaluation : Theme Options

THEME-ALL



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

THEME-SOME



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

*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

NOTHEME-ALL



Select the most suitable theme.

- ☐ food, ingredients
- ☐ food
- ☐ computer
- ☒ food, dessert
- ☐ music, melody, songs
- ☐ scare, fearful, silent, afraid

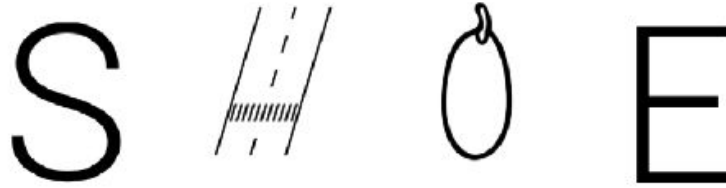
6 options

- 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

NOTHEME-SOME



Select the most suitable theme.

- ☐ soccer, black, white
- ☒ nike, sneaker, running
- ☐ nature, plant
- ☐ players, balls
- ☐ mythical beast, majestic, fire breathing
- ☐ 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 Options

FONT

CLOUDS

Select the most suitable theme.

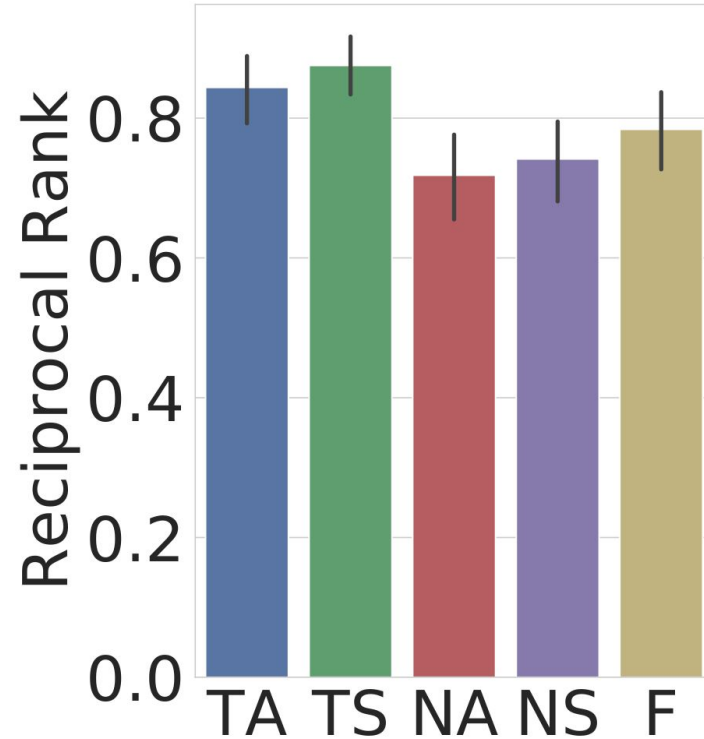
- ☐ weather, disaster
- ☐ cold, white, winter
- ☐ fruit
- ☒ sky, rain, weather
- ☐ fantasy
- ☐ sports

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



Evaluation : Creativity

THEME-ALL

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).



☐ Strongly agree



☐ Somewhat agree



☐ Neutral



☐ Somewhat disagree



☐ Strongly disagree

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

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

Evaluation : Creativity

THEME-SOME

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).



☐ Strongly agree



☐ Somewhat agree



☐ Neutral



☐ Somewhat disagree



☐ Strongly disagree

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

Evaluation : Creativity

NOTHEME-ALL

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).



☐ Strongly agree



☐ Somewhat agree



☐ Neutral



☐ Somewhat disagree



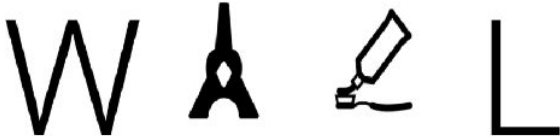
☐ Strongly disagree

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

Evaluation : Creativity

NOTHEME-SOME

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).



☐ Strongly agree



☐ Somewhat agree



☐ Neutral



☐ Somewhat disagree



☐ Strongly disagree

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

Evaluation : Creativity

FONT

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



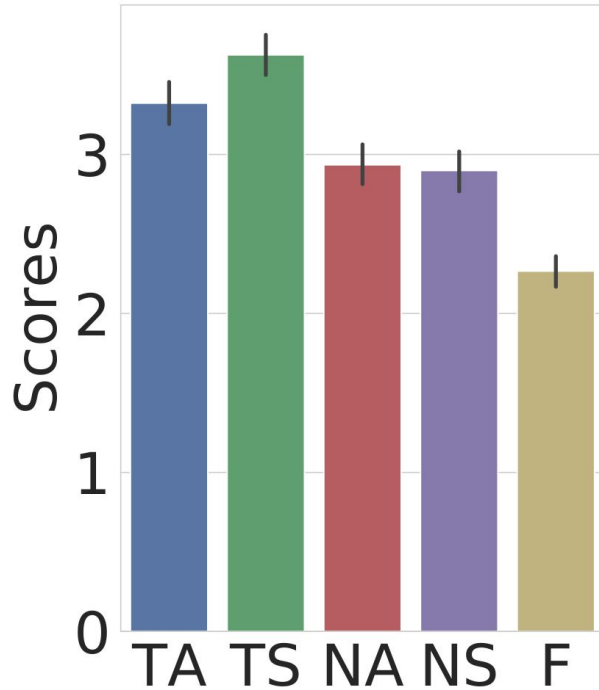
☐ Somewhat disagree



☐ Strongly disagree

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

Evaluation : Creativity



THEME-ALL



Word : ocean
Theme : fish,
waves, boats

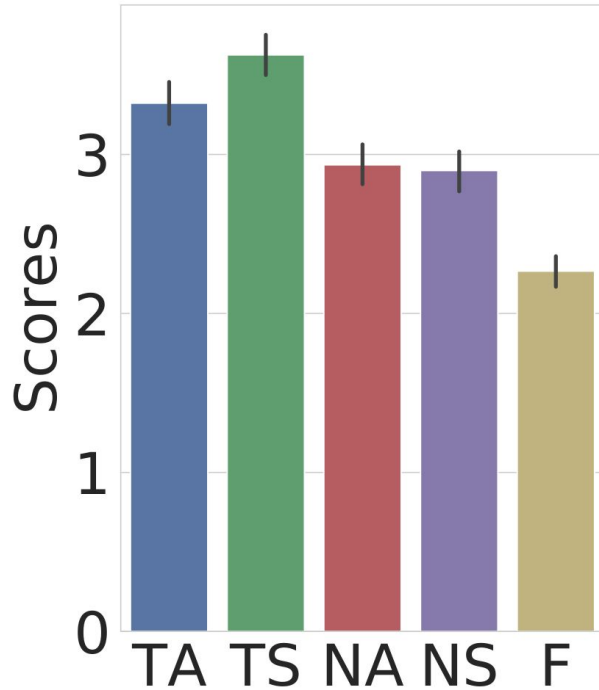
"cool characters and each one fits the theme of the ocean"



Word : Disney
Theme : amusement
parks, animated
movies

"Its creative and represents the theme well, but I don't see disney all that much."

Evaluation : Creativity



THEME-SOME



Word : wall
Theme : United States

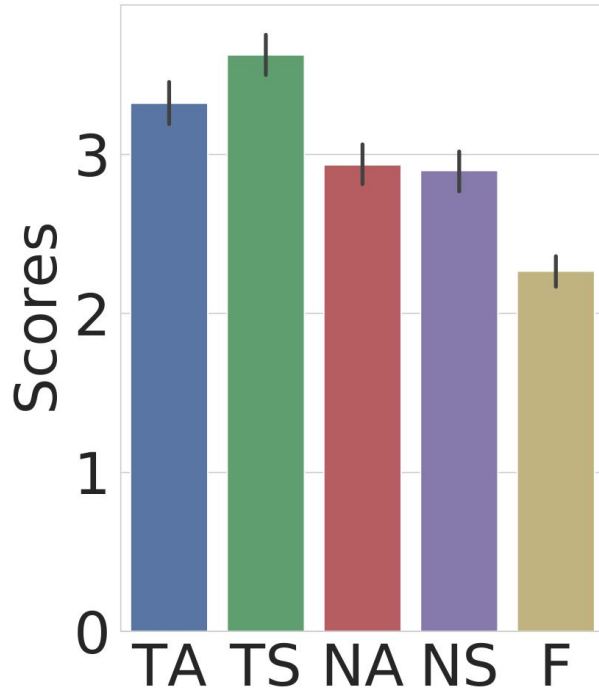
"I like how it uses the image of the US and then a state to spell out the word and looks like something you'd remember."



Word : mouse
Theme : computer

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

Evaluation : Creativity



NOTHEME-ALL



"It is creative but it has nothing to do with fear."

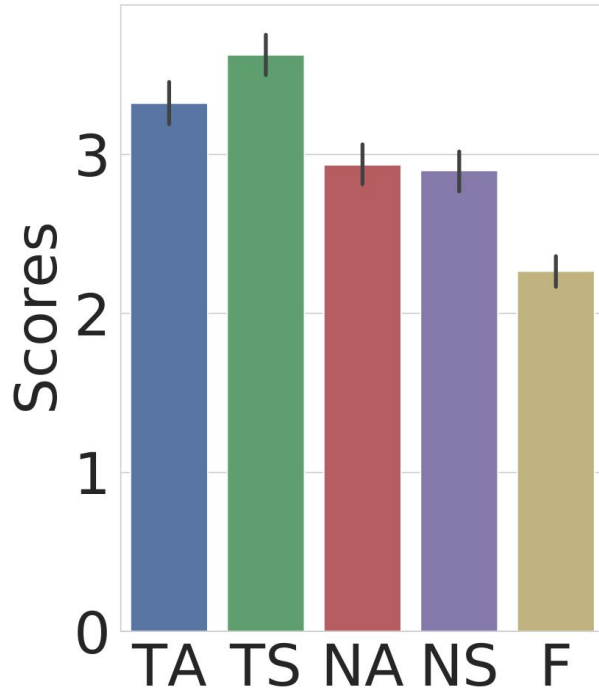
Word : coward
Theme : scare,
fearful, silent,
afraid



Word : Christmas
Theme : holiday
decorations

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

Evaluation : Creativity



NOTHEME-SOME



Word : driving
Theme : tire, car,
key

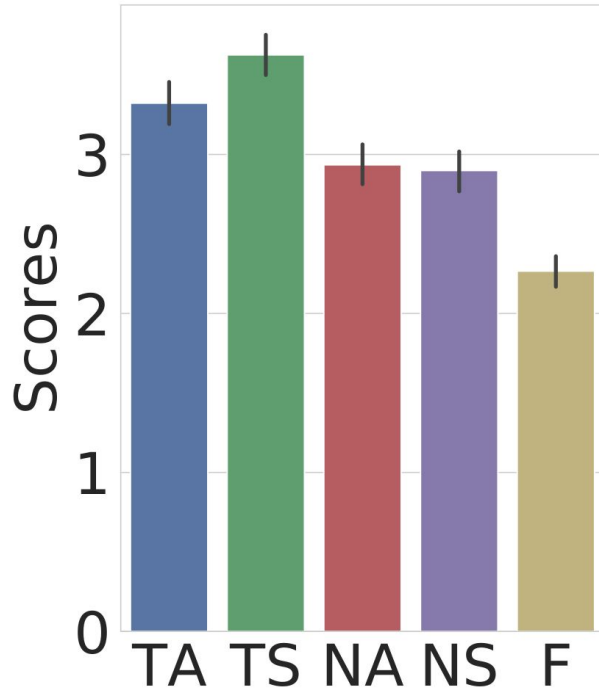
"It is somewhat creative, especially the unicorn head for "G", though I don't know what any of it has to do with the theme."



Word : wizard
Theme : magic, power,
mystery

"There are too many icons that seemingly have nothing to do with the theme."

Evaluation : Creativity



FONT

COWARD

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

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

PARROT

"Its not a doodle, its just the word Parrot, so I don't think its creative at all."

Word : parrot
Theme : birds,
tropical

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Future Work

- Drawbacks
- Interactive Interface

Future Work : Drawbacks

- No Clipart Relevance Score



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

- No Contextual Querying



Word : money
Theme : finance, banking,
support

- Imperfect Match Scores



Interactive Interface

- top-k matches
- Iteration over themes

Word : ocean
Theme : fish, waves,
boat

Demo

Summary

Thank You!

- **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>

Paper - <https://arxiv.org/abs/1903.07820>

Demo - <http://doodle.cloudcv.org/>