Using Neural Networks to Study Conceptual Shifts in Text and Image

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Overview

1. Advertisements as a Historical Source
2. Studying Images using Computer Vision
3. Back to Historical Advertisements: SIAMESE
4. Other Work and Possible Applications for Humanities Research
5. Some Final Thoughts...

Advertisements as a Historical Source

Background

- What does the career/genealogy of a concept tell us about today's dominant ways of understanding social change? (James & Steger, 2014)
- Ads offer "insight into the ideals and aspirations of past realities. They show the state of technology, the social functions of products, and provide information on the society in which a product was sold" (Marchand, 1985)

Background 2

- Dutch Digitized Newspapers archive (Delpher) contains $\approx$ 20 million advertisements (1890-1990)
- How can we use computation to detect/study concepts in large corpora of digitized ads?
- Possible subjects: representation of female consumers, national identities, material cultures

Multimodal Source

- Metadata
- Text
- Image

Figure 1: *Limburger Koerier*, April 13, 1938

Metadata: Size

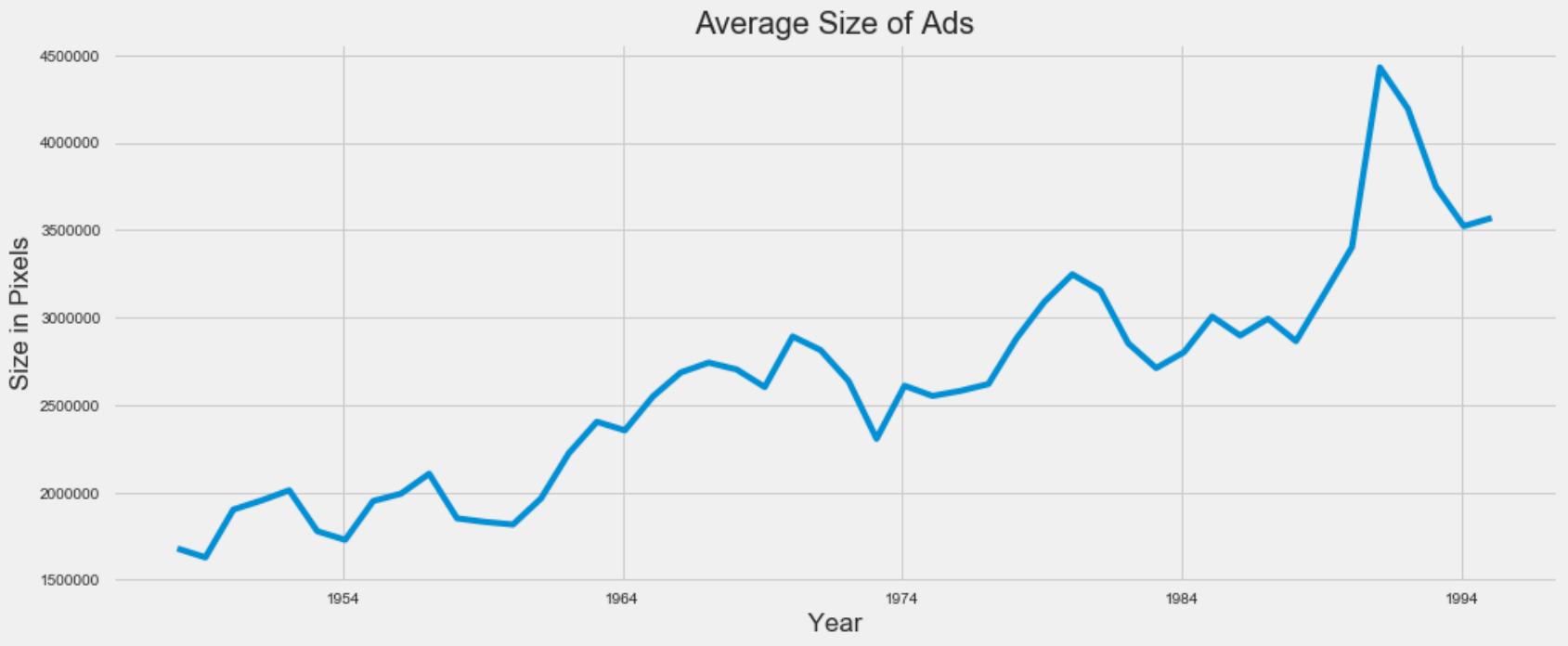


Figure 2: Average Size in *Algemeen Handelsblad & NRC*

Metadata: Position

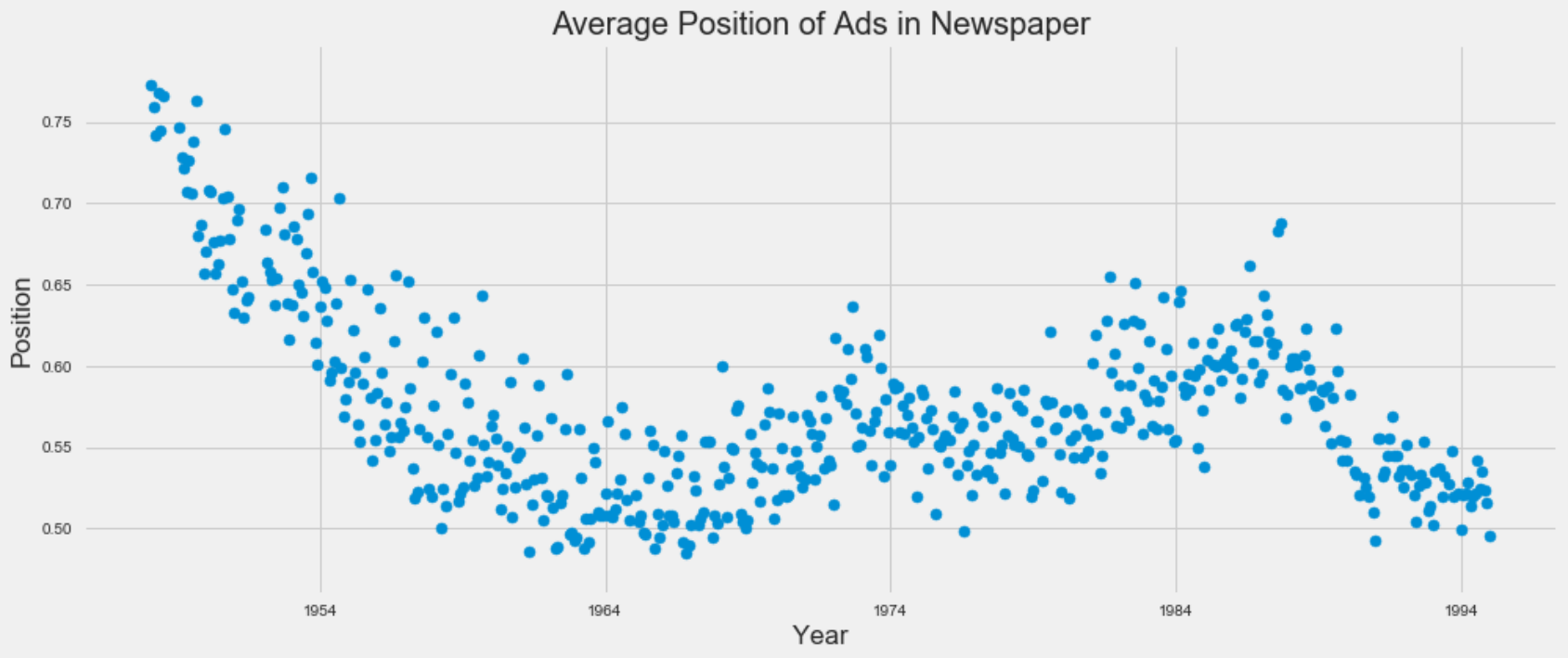


Figure 3: Average Position *Algemeen Handelsblad & NRC*

Image-Text Ratio

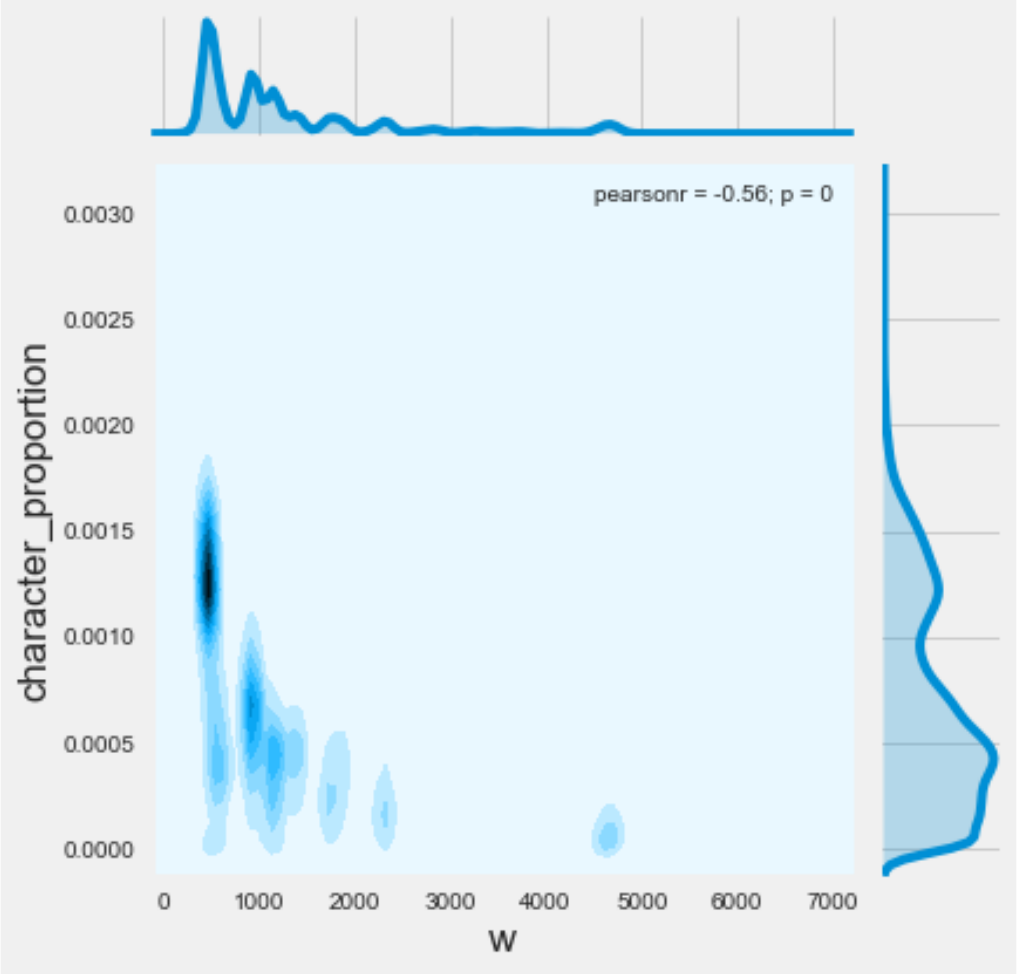


Figure 4: Image-Text Ratio vs Width

Text: Searching for Words in Ads

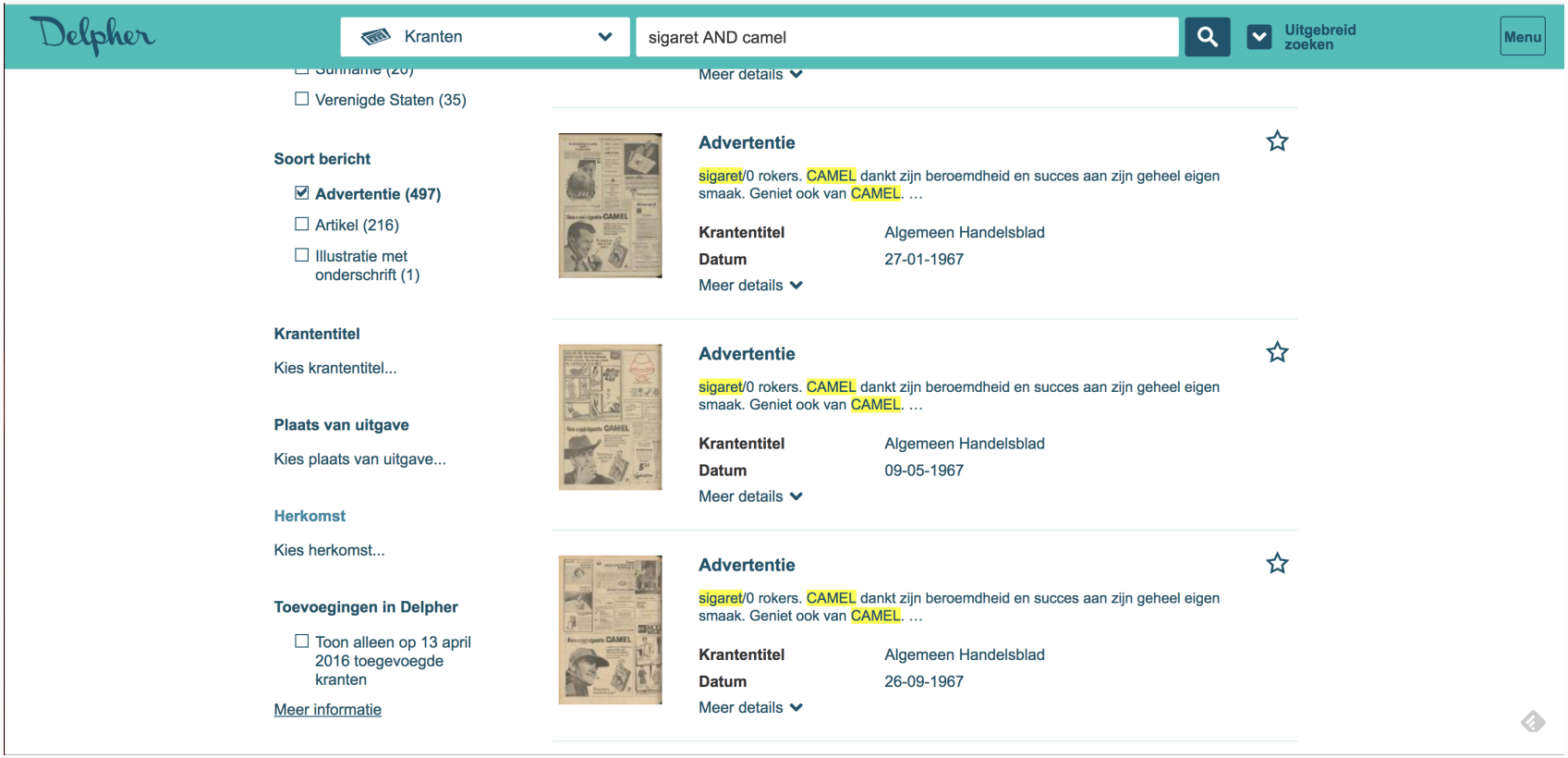


Figure 5: Searching Delpher for 'Sigaret' AND 'Camel'

Text: Co-occurence Analysis

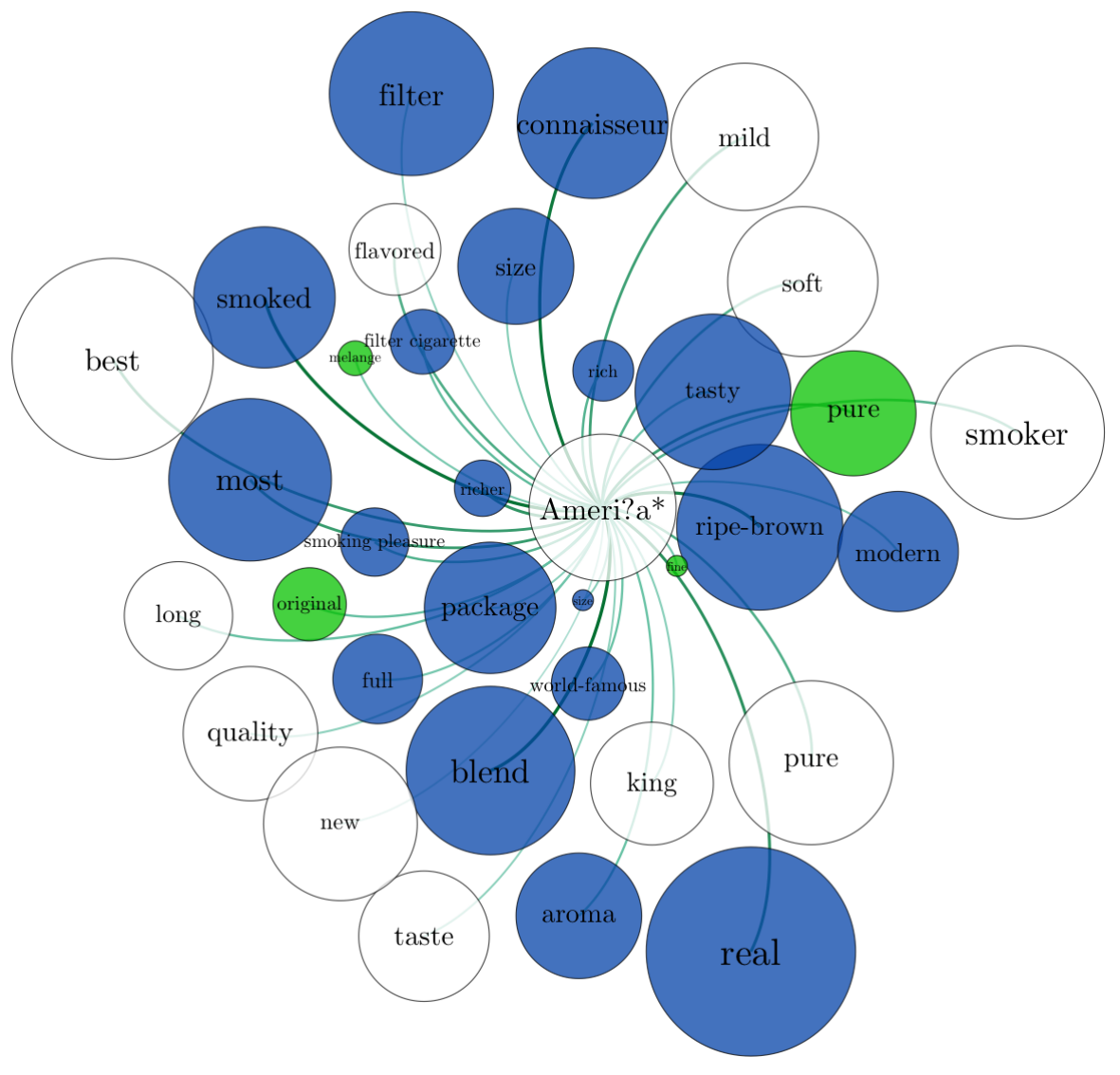


Figure 6: Characteristics of the American cigarette

Limitations of Text Analysis

Figure 7: Advertisement C&A

Studying Images using Computer Vision

Computer Vision

- Goal: Using computers to gain high-level understanding of images/video
- ImageNET: 1.2m images, 1000 classes
- Precision improved with popularization of neural networks

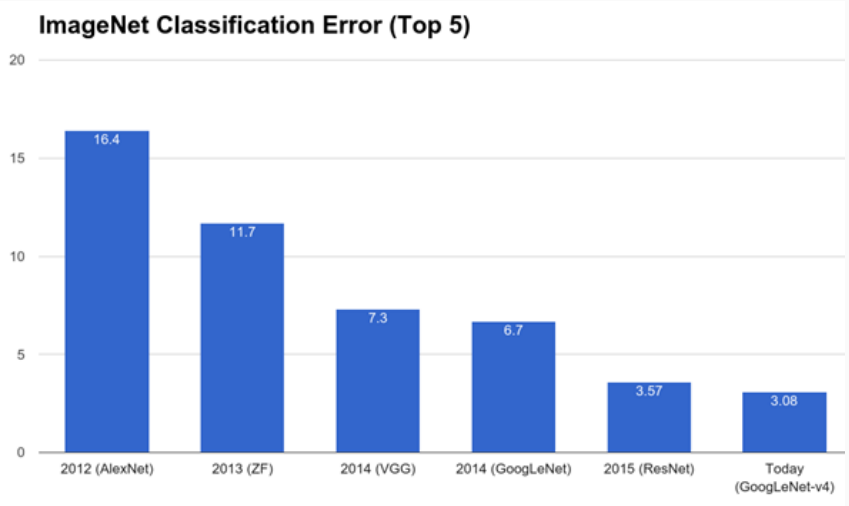


Figure 8: https://www.quora.com/What-is-the-state-of-the-art-today-on-ImageNet-classification-In-other-words-has-anybody-beaten-Deep-Residual-Learning

Images as Numbers

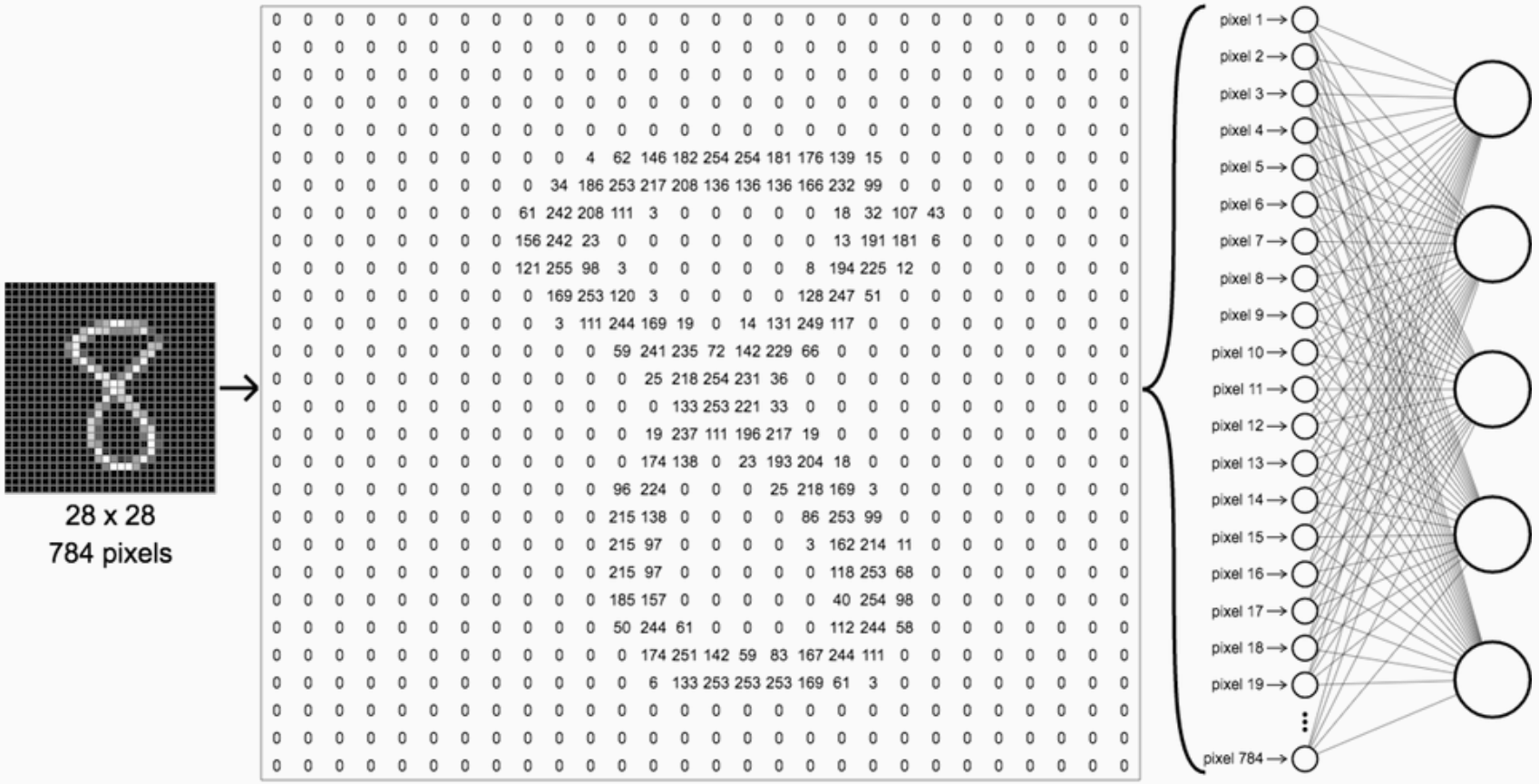


Figure 9: Input layer

Possible Convolutions

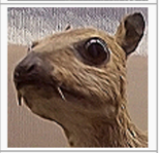
Operation	Filter	Convolved Image
Identity	$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 0 \end{bmatrix}$	
Edge detection	$\begin{bmatrix} 1 & 0 & -1 \\ 0 & 0 & 0 \\ -1 & 0 & 1 \end{bmatrix}$	
	$\begin{bmatrix} 0 & 1 & 0 \\ 1 & -4 & 1 \\ 0 & 1 & 0 \end{bmatrix}$	
	$\begin{bmatrix} -1 & -1 & -1 \\ -1 & 8 & -1 \\ -1 & -1 & -1 \end{bmatrix}$	
Sharpen	$\begin{bmatrix} 0 & -1 & 0 \\ -1 & 5 & -1 \\ 0 & -1 & 0 \end{bmatrix}$	
Box blur (normalized)	$\frac{1}{9}\begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$	
Gaussian blur (approximation)	$\frac{1}{16}\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 2 \\ 1 & 2 & 1 \end{bmatrix}$	

Figure 10: `https://ujjwalkarn.me/2016/08/11/intuitive-explanation-convnets/`

Neural Network Architecture for Image Classification

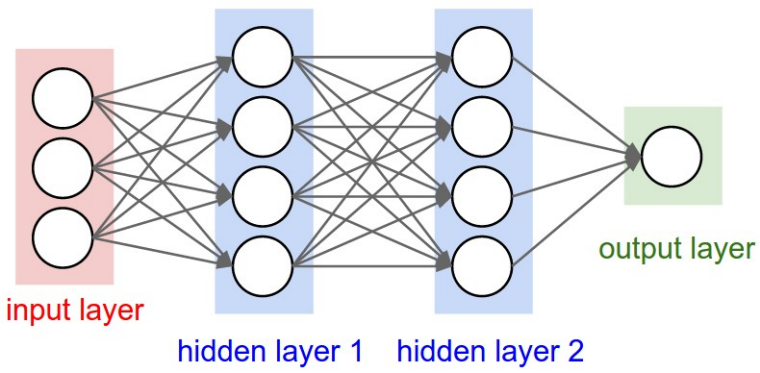


Figure 11: Neural Network. Visualization: `http://scs.ryerson.ca/~aharley/vis/conv/`

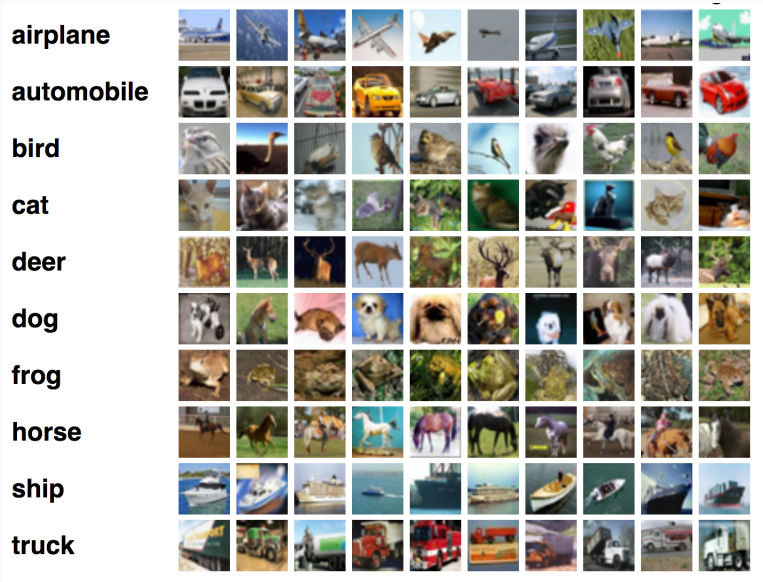


Figure 12: Output Layer

Classifying Images

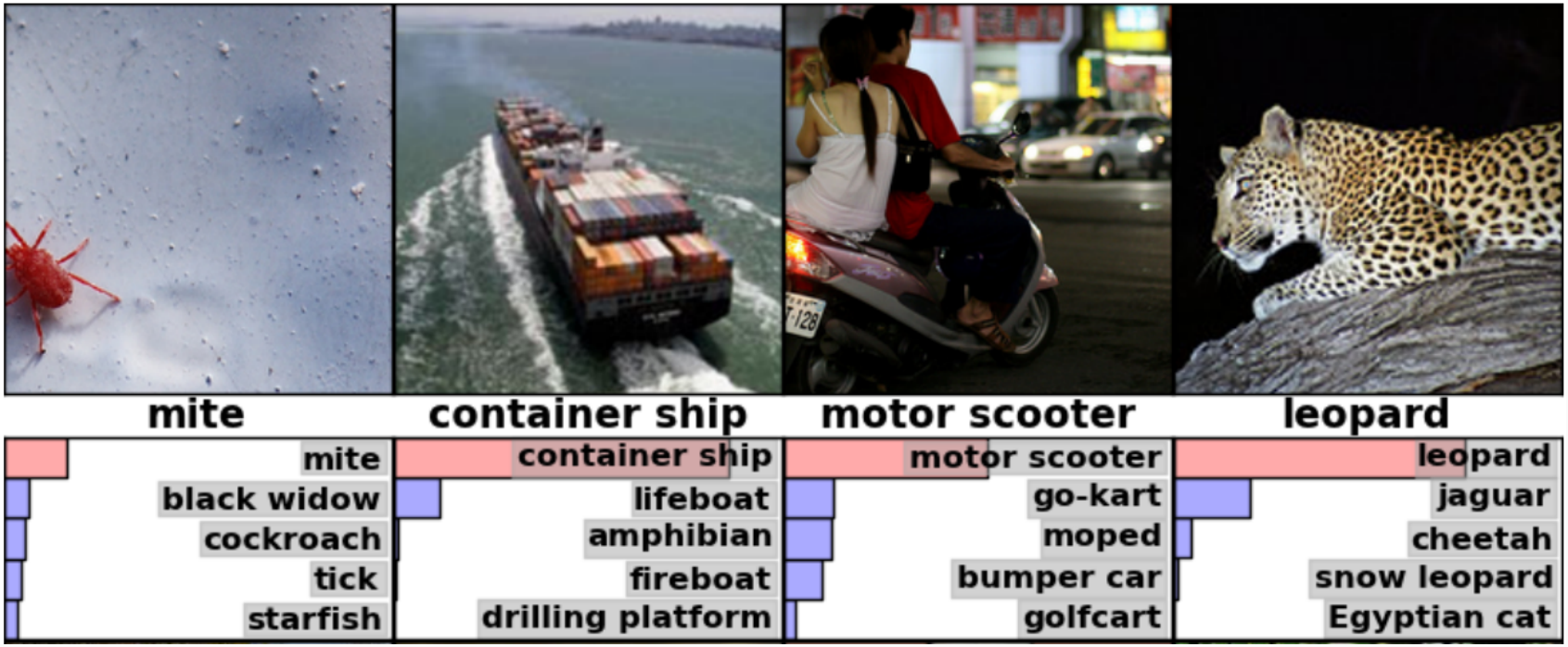


Figure 13: Precision of Classification

Back to Historical Advertisements: SIAMESE

Background SIAMESE Project

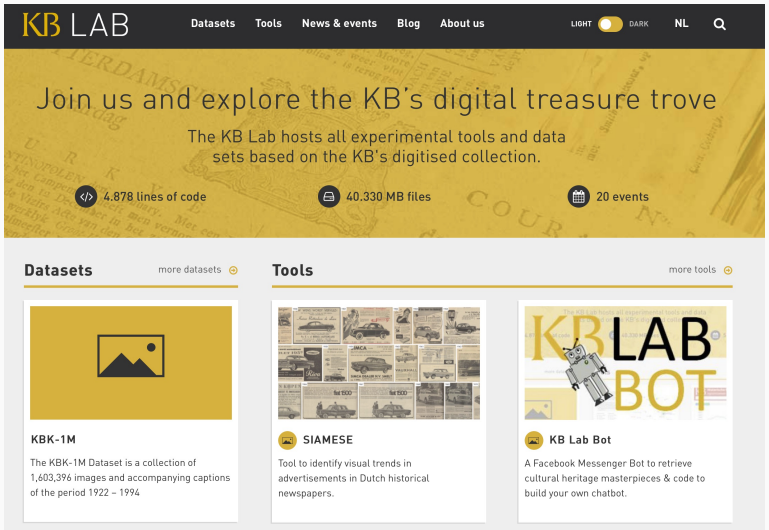


Figure 14: Screenshot of KB Lab website

- Developed during KB Researcher-in-Residentship
- Worked on this project together with Juliette Lonij
- Goal: get insights into visual trends
- To what extent can out-of-the-box neural networks be applied to historical advertisements?

Preparing the Dataset

- Raw data: $\approx$ 1.6m advertisements from two national newspapers between 1948-1995
- Data cleaning:
  - Small ads
  - Classified ads
  - Ads with predominantly text
- Result: 426,777 ads between 1945-1995

Tasks

- Select image representation in penultimate layer
- Cluster in multidimensional space based on 2,048 (abstract) visual aspects
- Find nearest neighbors in clustered space)
- Time line with most similar images per year

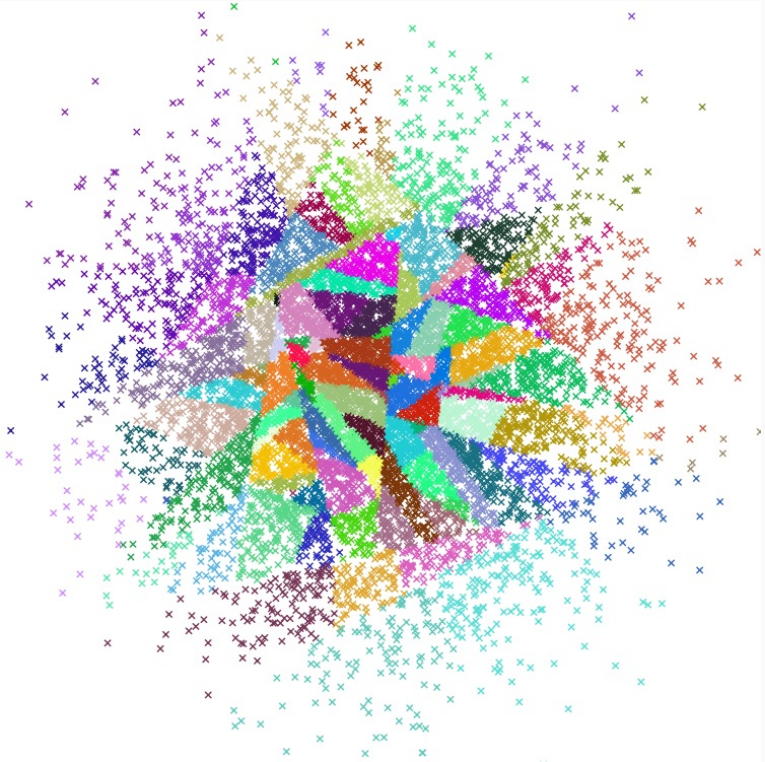


Figure 15: Annoy: Approximate Nearest Neighbor

SImilar AdvertiseMEnt SEarch

Figure 16: Query cars

Figure 17: Query fashion

Other Work and Possible Applications for Humanities Research

Other work

- Caption generation:
  `https://github.com/neural-nuts/image-caption-generator`
- Posture detection: `https://github.com/MVIG-SJTU/AlphaPose`:
- Generative art:`http://mario-klingemann.tumblr.com`

Future Steps

- We need more labeled data
- Combination of textual and visual analysis
- Collaboration between Computer Science and the Humanities

Some Final Thoughts...

Final Thoughts

- Access to resources
- Reductionism as a way forward to more fine-grained analysis
- Bias in training algorithms

Question/Comments

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