Sapienza Training Camp 2020

Building an Image Search Engine

3 - 5 September, 2020

Instructor team

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Organization

- Website: sapienza-training-camp2020.github.io
- Getting started doc (link)
- Ask questions on Piazza (https://piazza.com/google/fall2020/tcse2020)

- Course format:
  - Competition on Kaggle
  - Lectures: 15-20 minute blocks with quiz in the end

Image search engine

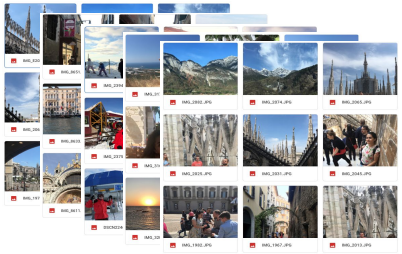


Photo collection
(e.g. pictures from the last vocation or a database of web images)

Query: “Dog in glasses sitting in a basket on a bike”

Image search engine

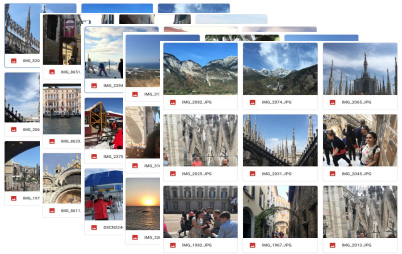


Photo collection
(e.g. pictures from the last vocation or a database of web images)

Search engine

Query: “Dog in glasses sitting in a basket on a bike”

Result: images in the collection ordered by relevance with respect to the query

Image search engine

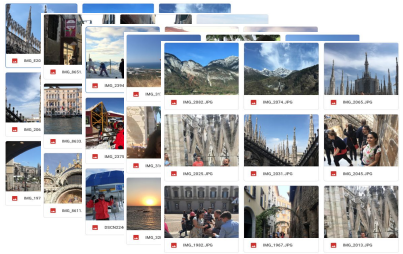
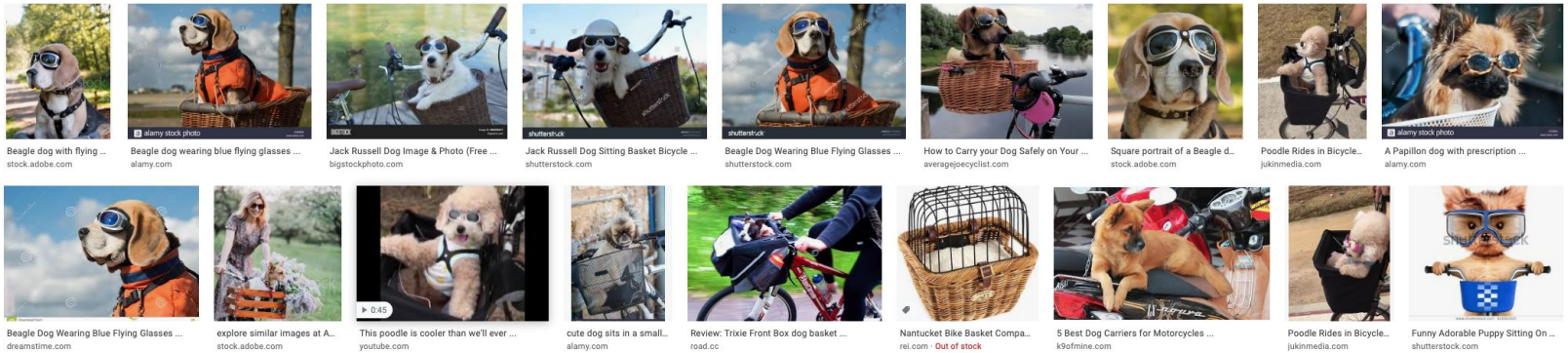


Photo collection
(e.g. pictures from the last vocation or a database of web images)

Search engine

Query: “Dog in glasses sitting in a basket on a bike”



Result: images in the collection ordered by relevance with respect to the query

Disclaimer: we will skip a lot of details

- Skip a lots of technical aspects related to implementation of the real search engine
  - e.g. how to build a system that can store and index terabytes of data
- Focus on image content only
  - ignore the location where the photograph has been taken
  - ignore text of the webpage that contains the image
- Consider each photograph individually
  - we won’t build models for places or specific people

Focus on “learning by doing”

- You will develop your own version of the “search engine” and participate in the in-class Kaggle competition (more about it later today)
- Lectures will closely follow the code you will use in your implementation
  - experiment with the code to learn what works best
- Lecture followed by a quiz to recall what you learned
  - quizzes are for you to test yourself (can take quiz multiple times)
  - best strategy: take a quiz after the lecture and then again 2-3 days later (test your memory)

Roadmap

Image from the photo collection

I_k

Q

Query: “dog in glasses sitting in a basket on a bike”

Roadmap

Image from the photo collection

I_k

Neural Network (CNN)

Image encoding

φ_k

Q

Query: “dog in glasses sitting in a basket on a bike”

Roadmap

Image from the photo collection

I_k

Neural Network (CNN)

Image encoding

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Recurrent neural network (RNN)

Image description

T_k

= “dog next to person on the bike near street crossing”

Q

Query: “dog in glasses sitting in a basket on a bike”

Roadmap

Image from the photo collection

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Neural Network (CNN)

Image encoding

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Recurrent neural network (RNN)

Image description

T_k

= “dog next to person on the bike near street crossing”

Define similarity function. Order images according to similarity to the query.

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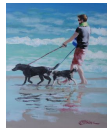
Query: “dog in glasses sitting in a basket on a bike”



$$\text{sim}(Q, T_1) > \text{sim}(Q, T_2)$$

Day 1

Image from the photo collection

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Image encoding

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Recurrent neural network (RNN)

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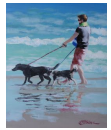


$$\text{sim}(Q, T_1) > \text{sim}(Q, T_2)$$

Day 2

Image from the photo collection

I_k

Neural Network (CNN)

Image encoding

φ_k

Recurrent neural network (RNN)

Image description

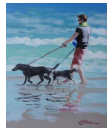
T_k

= “dog next to person on the bike near street crossing”

Define similarity function. Order images according to similarity to the query.

Q

Query: “dog in glasses sitting in a basket on a bike”



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$$\text{sim}(Q, T_1) > \text{sim}(Q, T_2)$$

Day 3

Image from the photo collection

I_k

Neural Network (CNN)

Image encoding

φ_k

Recurrent neural network (RNN)

Image description

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= “dog next to person on the bike near street crossing”

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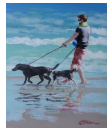
Query: “dog in glasses sitting in a basket on a bike”

Define similarity function. Order images according to similarity to the query.



$$\text{sim}(Q, T_1) > \text{sim}(Q, T_2)$$

Course schedule

Day 1 (Thursday, 3rd of September)

Module	Time	Quiz	Additional material	Notes
Introduction to the training camp	10:00 - 10:30	-	-	-
Computer vision and deep learning	10:30 - 11:30	-	Machine learning with Tensorflow2, Books: Deep learning, Deep learning with Python	-
Introduction to the Kaggle competition	13:30 - 14:00	-	-	-

Day 2 (Friday, 4th of September)

Module	Time	Quiz	Additional material	Notes
Neural Networks for Natural Language Processing (NLP)	13:30 - 15:00	-	Visualizing and Understanding Recurrent Networks, A Simple but Tough-to-Beat Baseline for Sentence Embeddings	-

Day 3 (Saturday, 5th of September)

Module	Time	Quiz	Additional material	Notes
Image captioning. Attention models in computer vision and NLP.	10:00 - 11:30	-	Show, Attend and Tell: Neural Image Caption Generation with Visual Attention, Image captioning colab	-
Announcement of the Kaggle competition results. Short presentations by the competition winners.	17:00 - 17:30	-	-	-

for up-to-date schedule check the course webpage
sapienza-training-camp2020.github.io

Kaggle competition

- Competition is hosted on Kaggle (www.kaggle.com)
- You can participate in teams of at most 3 people
  - Organize yourself into teams
  - Register the team by sending an email to Prof. Galasso
- Two tracks: “Starter” and “Advanced”
  - “Starter” track is for those of you who already didn’t yet attended a computer vision or machine learning class

- Saturday 4pm: end of the competition, winner announcement, short presentations by the winning teams

Kaggle competition

- Competition is based on the COCO Dataset: https://cocodataset.org/#explore

- The COCO dataset provides a set of images and their textual descriptions:

a cat laying on the keyboard of a computer.
a cat laying on top of a laptop computer keyboard.
a cat that is laying on top of a laptop.
a cat sitting across the keyboard of a computer
a cat sits on top of a laptop computer.

a large three layered cake with yellow filling sliced on a white plate
a cake on a plate, on the ground, with four slices cut.
a close up of food on a plate being cut into slices
someone has begun to cut the cake into slices.
a cake with white icing being sliced with a knife.

Kaggle competition

- In the competition you will be given a set of images and a corresponding set of textual queries
- Your task:
  - compare query with each of the images
  - generate list of images sorted by similarity to the query = implement image search!
- Don’t panic! We will provide you with a starting code package :)
- More details today at 1:30pm

Looking forward to the next three days!

Good luck for the competition!

Take a quiz!