KŌNIGSWEG

PyParis

Deep Learning for Fun and Profit, Pt. 2.25

Alexander CS Hendorf

KÖNIGSWEG

Alexander C. S. Hendorf

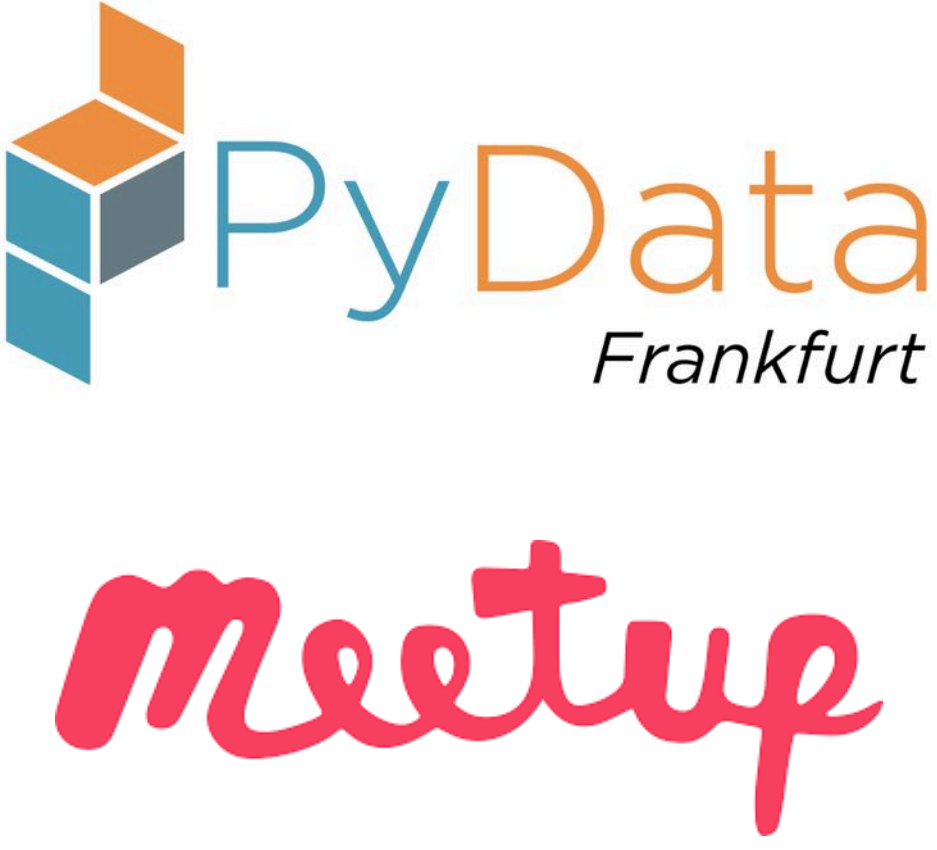
ah@koenigsweg.com
@hendorf

- Partner & Senior Consultant Information Technology Consulting & Training on Data Science Matters
- Program Chair EuroPython, EuroSciPy, PyConDE & PyData, PSF Managing Member
- Speaker Europa & USA MongoDB World New York / San José, PyCon Italy, CEBIT Developer World, BI Forum, IT-Tage FFM, PyData, PyParis,...

KÖNIGSWEG

We think digital excellence. We do digital excellence.

- STRATEGY & INNOVATION
- DATA & ARTIFICIAL INTELLIGENCE
- CREATIVE & COMMUNICATION
- SCALABILITY & GROWTH
- OPEN ECOSYSTEMS & CONNECTIVITY


PyData
Frankfurt
meetup

The Story So Far...

-

How I Made My Computer Write it's First Short Story
PyData Berlin 2018

https://www.youtube.com/watch?v=jCll02teu1k

Deep Learning with PyTorch for Fun and Profit
EuroPython 2018

https://www.youtube.com/watch?v=_uNgNhdlB7U

The Inspiration

Gene Kogan
Picasso's terminal
data science and AI in the visual arts

PyData London 2017

https://www.youtube.com/watch?v=JXx2MYtAU3o

The lab: eGPU

- External Box, 500W, carries a GPU
- Thunderbolt 3 Connection
- NVIDIA GTX-1080
- It's not *plug-and-play*
- great source for troubleshooting and advice
  egpu.io

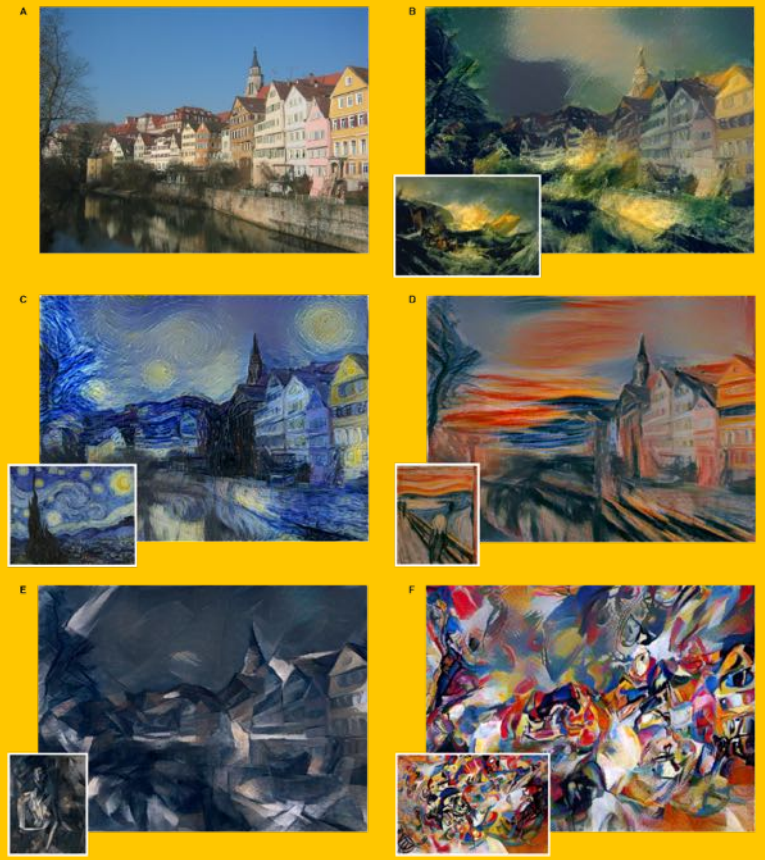
PYTORCH

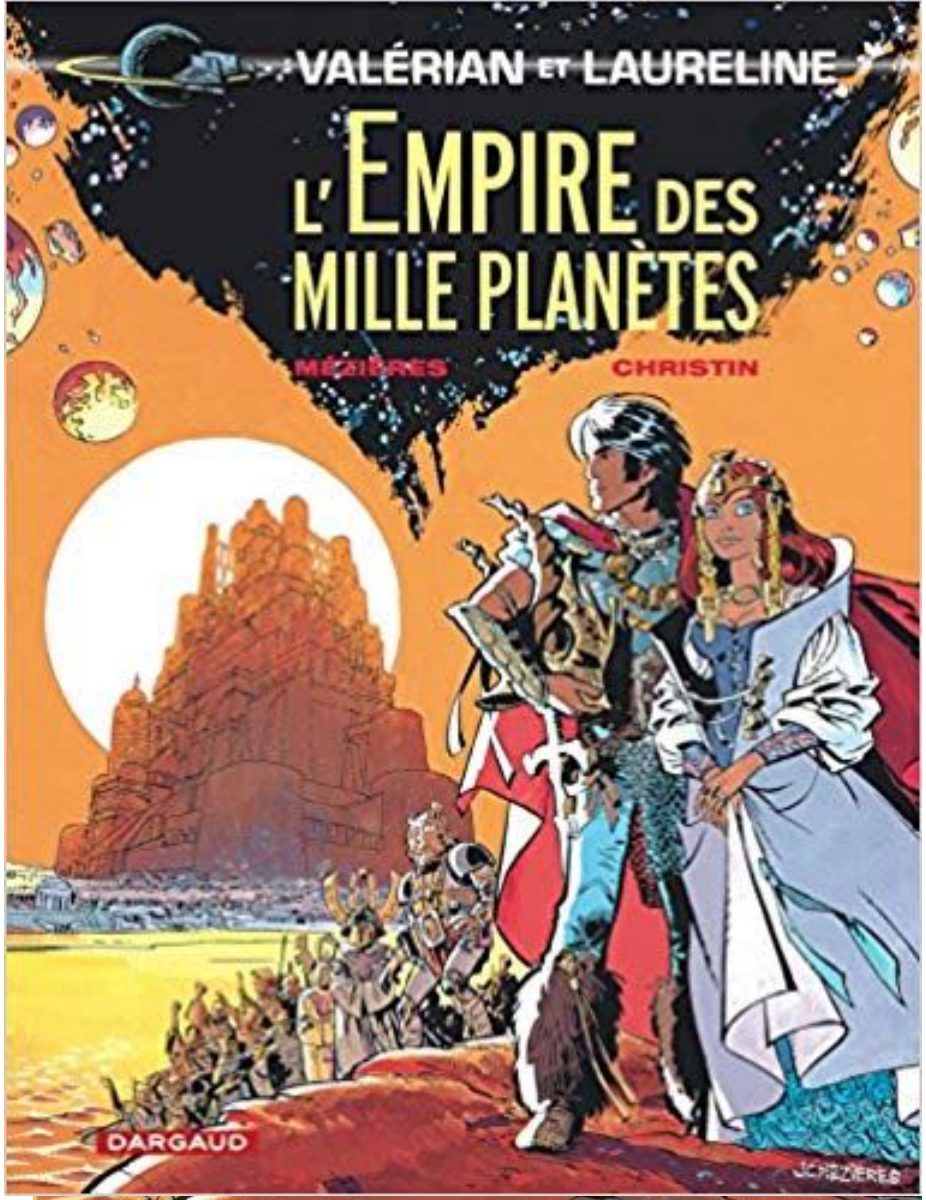
The Journey #1: Style Transfer

A Neural Algorithm of Artistic Style

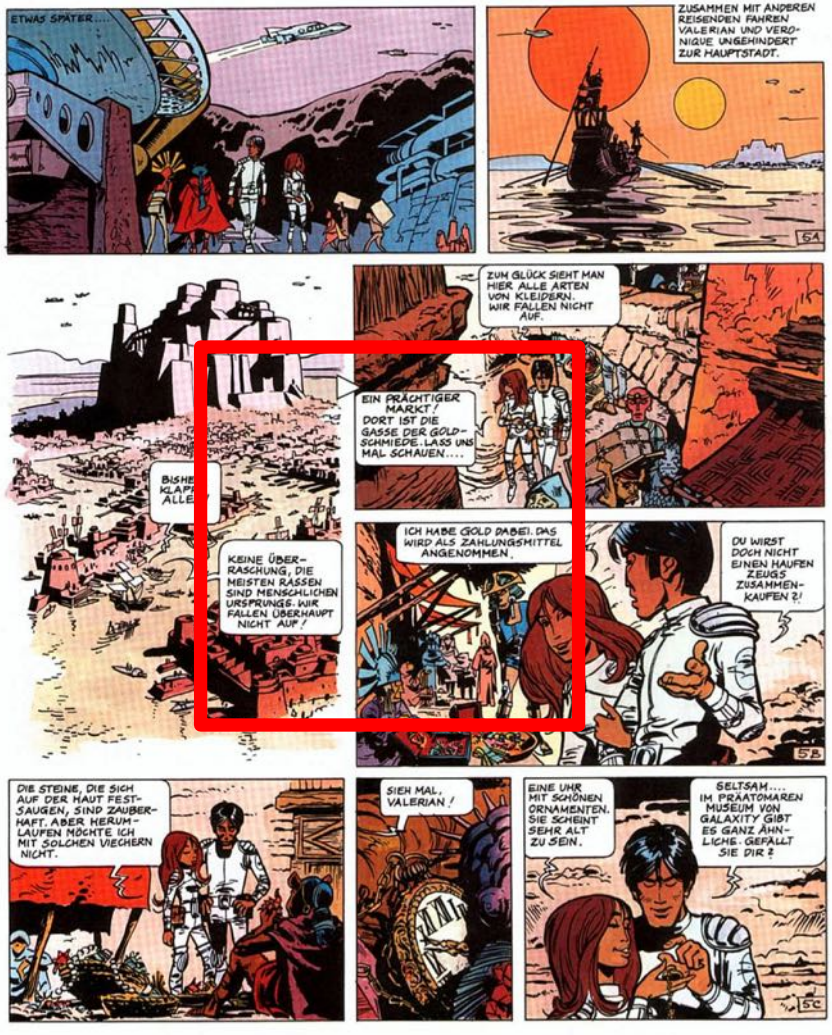
2015 Leon A. Gatys, Alexander S. Ecker, Matthias Bethge

https://arxiv.org/abs/1508.06576

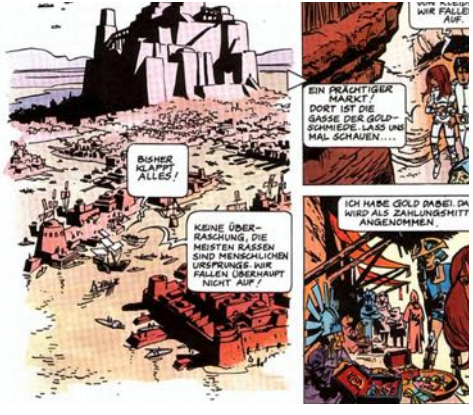



VALÉRIAN ET LAURELINE
L'EMPIRE DES MILLE PLANÈTES
MÉZIÈRES
CHRISTIN
DARGAUD

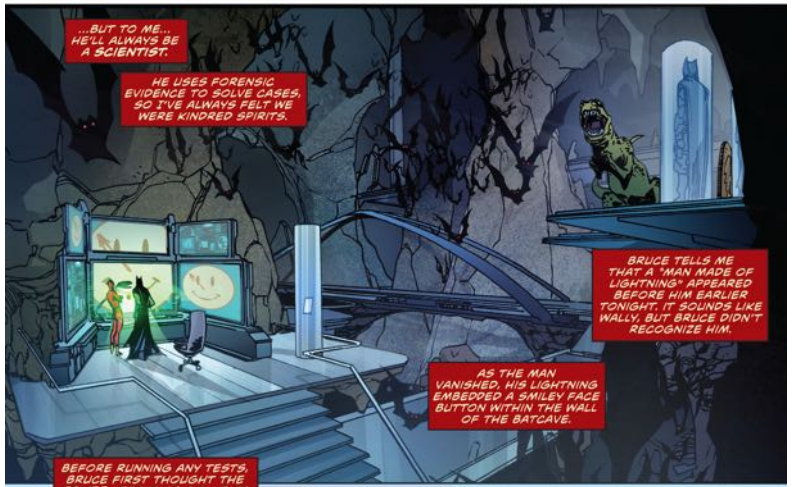
DC
The FLASH
1
REBIRTH
WILLIAMSON
DI GIANDOMENICO
PLASCENCIA
RATED T TEEN

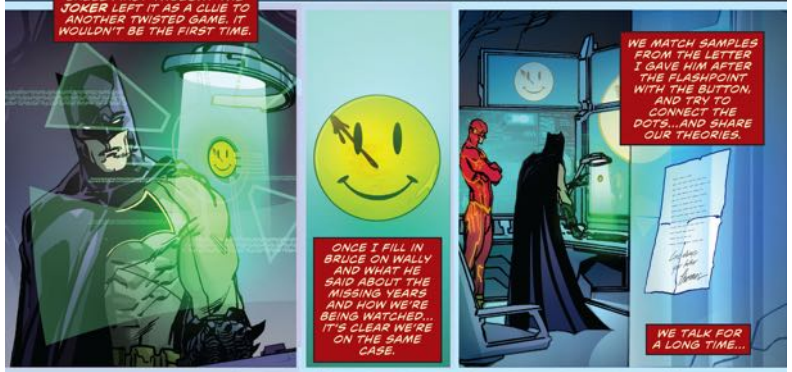

ETWAS SPÄTER...
ZUSAMMEN MIT ANDEREN REISENDEN FAHREN VALERIAN UND VERONIQUE UNGEHINDERT ZUR HAUPTSTADT.
5A
ZUM GLÜCK SIEHT MAN HIER ALLE ARTEN VON KLEIDERN. WIR FALLEN NICHT AUF.
EIN PRÄCHTIGER MARKT! DORT IST DIE GASSE DER GOLDSCHMIEDE. LASS UNS MAL SCHAUEN....
KEINE ÜBERRASCHUNG, DIE MEISTEN RASSEN SIND MENSCHLICHEN URSPRUNGS. WIR FALLEN ÜBERHAUPT NICHT AUF!
ICH HABE GOLD DABEI. DAS WIRD ALS ZAHLUNGSMITTEL ANGENOMMEN.
DU WIRST DOCH NICHT EINEN HAUFEN ZEUGS ZUSAMMENKAUFEN?!
5B
DIE STEINE, DIE SICH AUF DER HAUT FESTSAUGEN, SIND ZAUBERHAFT. ABER HERUMLAUFEN MÖCHTE ICH MIT SOLCHEN VIECHERN NICHT.
SIEH MAL, VALERIAN!
EINE UHR MIT SCHÖNEN ORNAMENTEN. SIE SCHEINT SEHR ALT ZU SEIN.
SELTSAM.... IM PRÄATOMAREN MUSEUM VON GALAXITY GIBT ES GANZ ÄHNLICHE. GEFÄLLT SIE DIR?
5C

BARRY SAVED ME.
WILLY THINKS THAT? I SAVED HIM.
THAT'S TWICE HE'S GIVEN ME THIS LIFE...
THAT I BROUGHT HIM BACK...
THE GREATEST LIFE A KID COULD EVER ASK FOR.
BUT REALLY...
WILLY BROUGHT ME BACK...


BISHER KLAPPT ALLES!
KEINE ÜBERRASCHUNG, DIE MEISTEN RASSEN SIND MENSCHLICHEN URSPRUNGS. WIR FALLEN ÜBERHAUPT NICHT AUF!
EIN PRÄCHTIGER MARKT! DORT IST DIE GASSE DER GOLDSCHMIEDE. LASS UNS MAL SCHAUEN....
ICH HABE GOLD DABEI. DA WIRD ALS ZAHLUNGSMITT ANGENOMMEN.

WELCOME to GOTHAM
I WAS RIGHT. BATMAN IS ALREADY WORKING AN ANGLE.
EVERYONE THINKS OF BRUCE AS A DETECTIVE...


...BUT TO ME... HE'LL ALWAYS BE A SCIENTIST.
HE USES FORENSIC EVIDENCE TO SOLVE CASES, SO I'VE ALWAYS FELT WE WERE KINDRED SPIRITS.
BRUCE TELLS ME THAT A "MAN MADE OF LIGHTNING" APPEARED BEFORE HIM EARLIER TONIGHT. IT SOUNDS LIKE WALLY, BUT BRUCE DIDN'T RECOGNIZE HIM.
AS THE MAN VANISHED, HIS LIGHTNING EMBEDDED A SMILEY FACE BUTTON WITHIN THE WALL OF THE BATCAVE.


BEFORE RUNNING ANY TESTS, BRUCE FIRST THOUGHT THE JOKER LEFT IT AS A CLUE TO ANOTHER TWISTED GAME. IT WOULDN'T BE THE FIRST TIME.
ONCE I FILL IN BRUCE ON WALLY AND WHAT HE SAID ABOUT THE MISSING YEARS AND HOW WE'RE BEING WATCHED... IT'S CLEAR WE'RE ON THE SAME CASE.
WE MATCH SAMPLES FROM THE LETTER I GAVE HIM AFTER THE FLASHPOINT WITH THE BUTTON, AND TRY TO CONNECT THE DOTS...AND SHARE OUR THEORIES.
WE TALK FOR A LONG TIME...

WELCOME to GOTHAM
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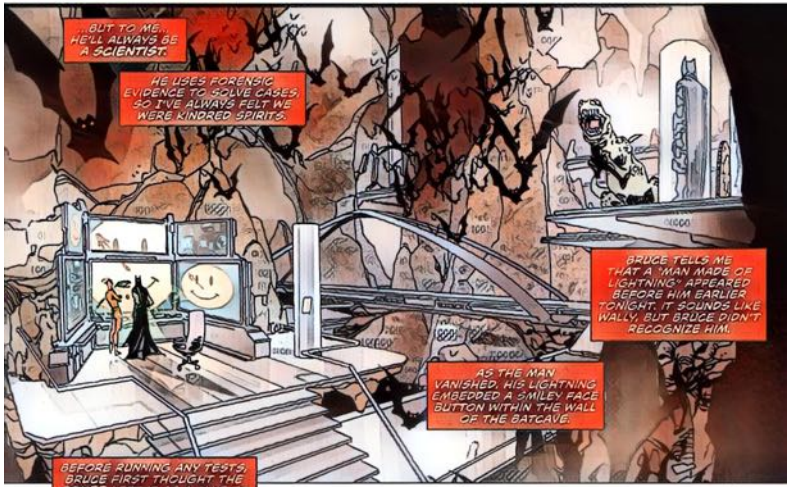
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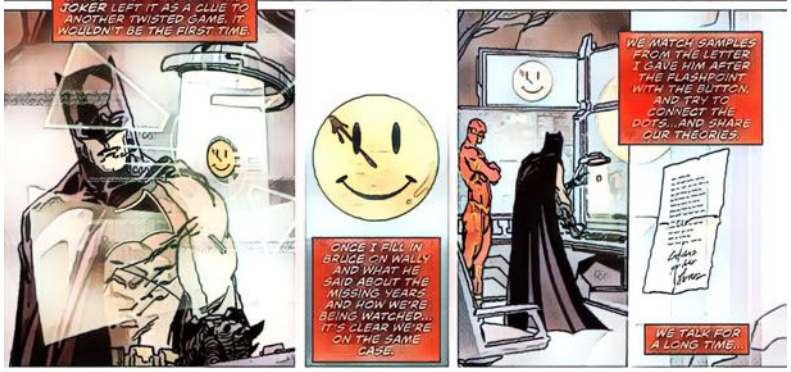
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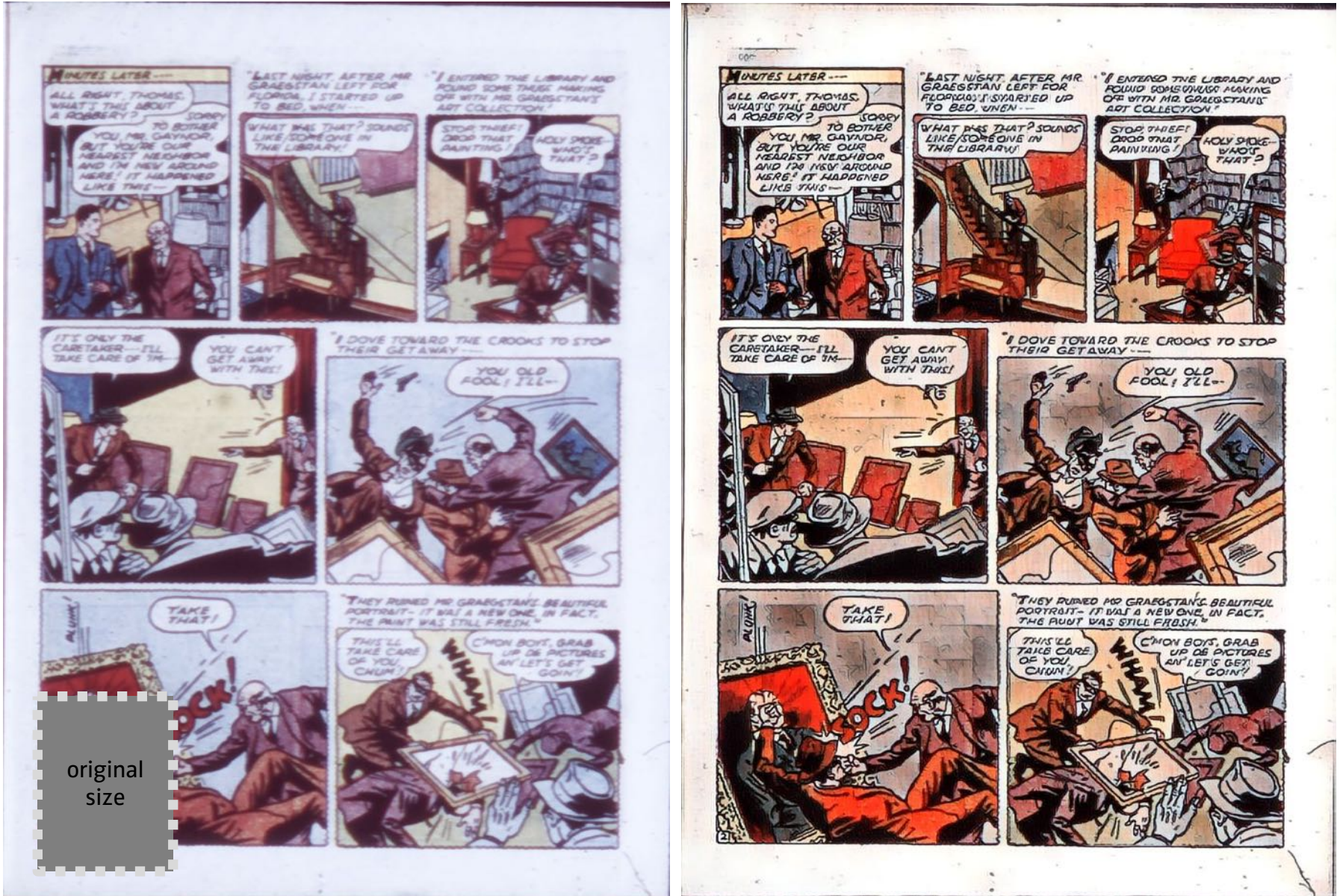
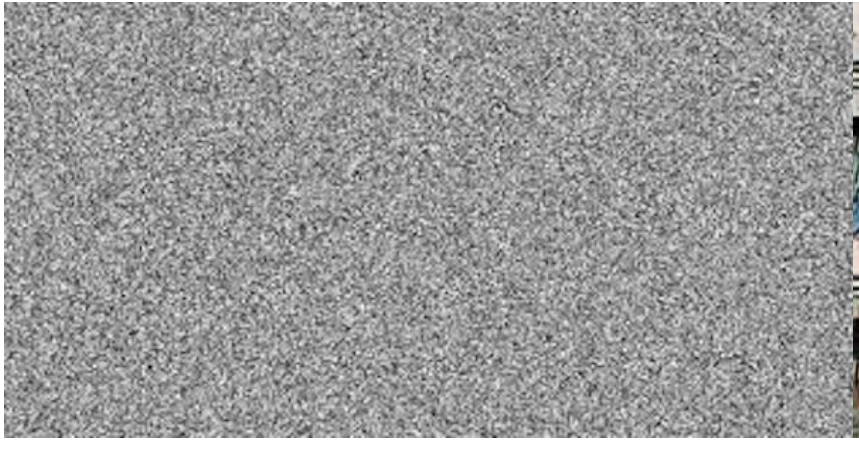
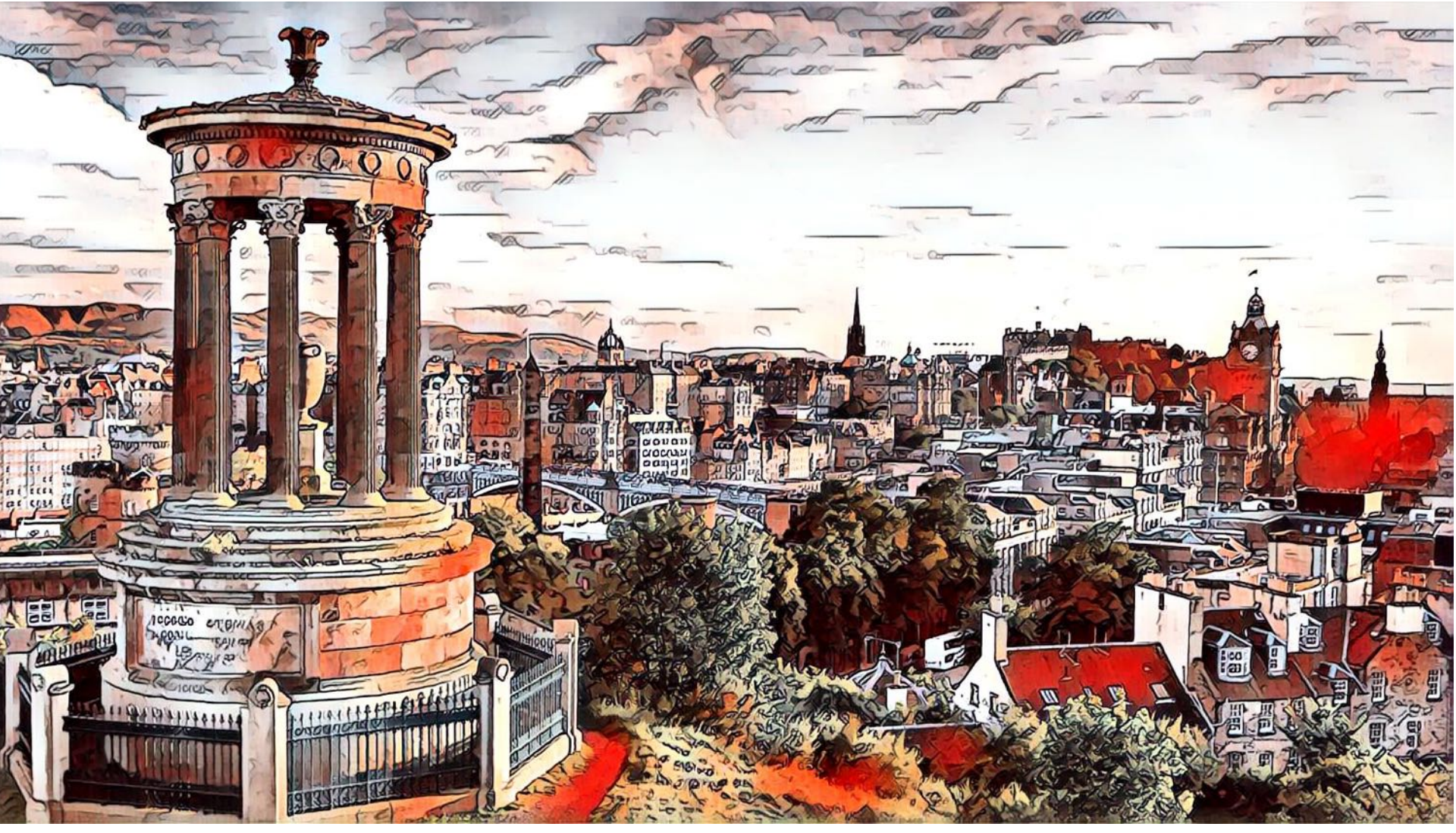


original size

AAHH!





Alexander CS Hendorf
@hendorf

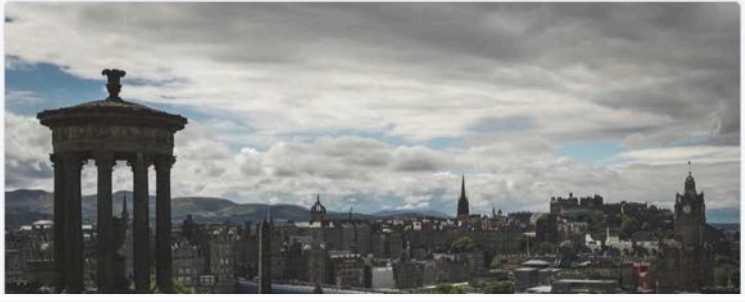
I'll be talking about some Deep Learning use cases for content creation at 10:30 #EuroPython Edinburg #PyData

ep2018.europython.eu/conference/tal …

Tweet übersetzen

11:07 - 26. Juli 2018

Thomas Rackow @TRackow · 27. Juli
Antwort an @hendorf



Thomas Rackow @TRackow · 27. Juli
I took this picture a few days ago and was wondering when you posted that drawing.

Tweet übersetzen

1

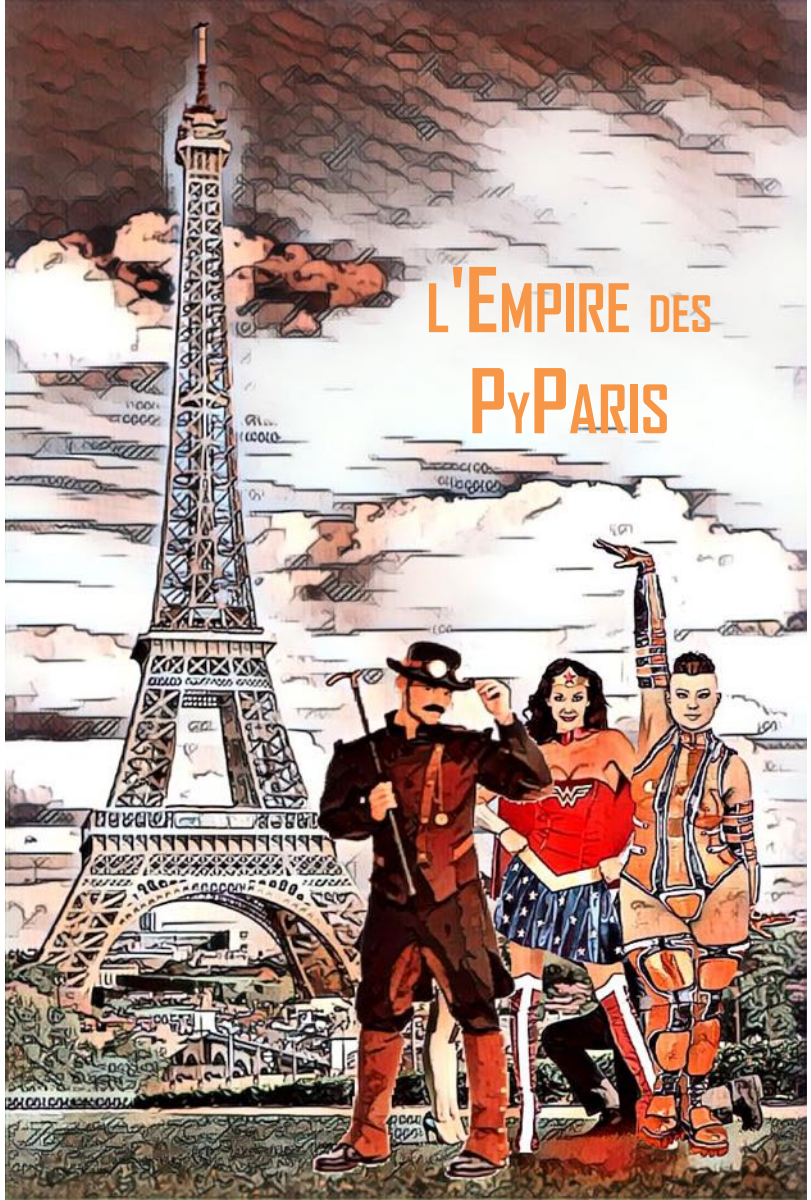
Alexander CS Hendorf @hendorf · 27. Juli
It's not a drawing, it was generated with artificial intelligence

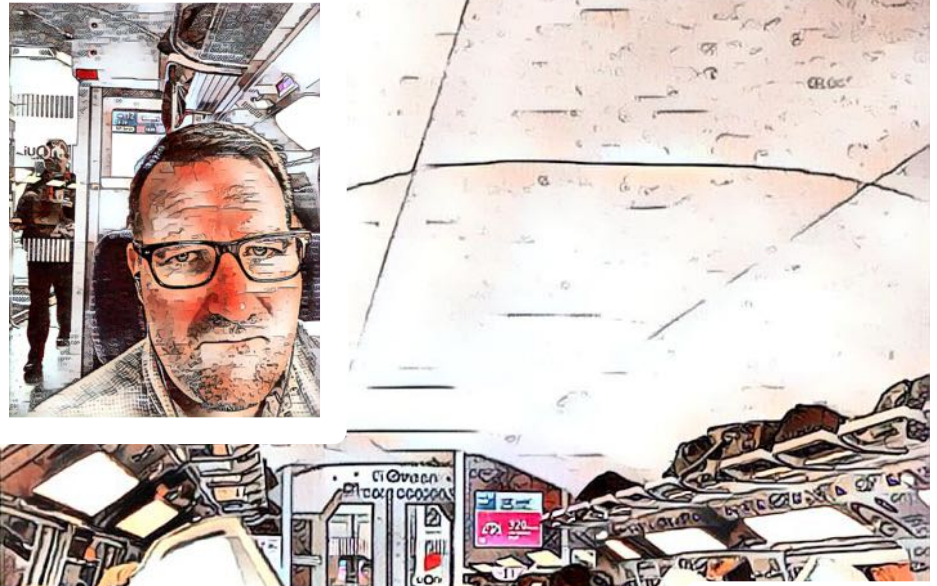
Tweet übersetzen

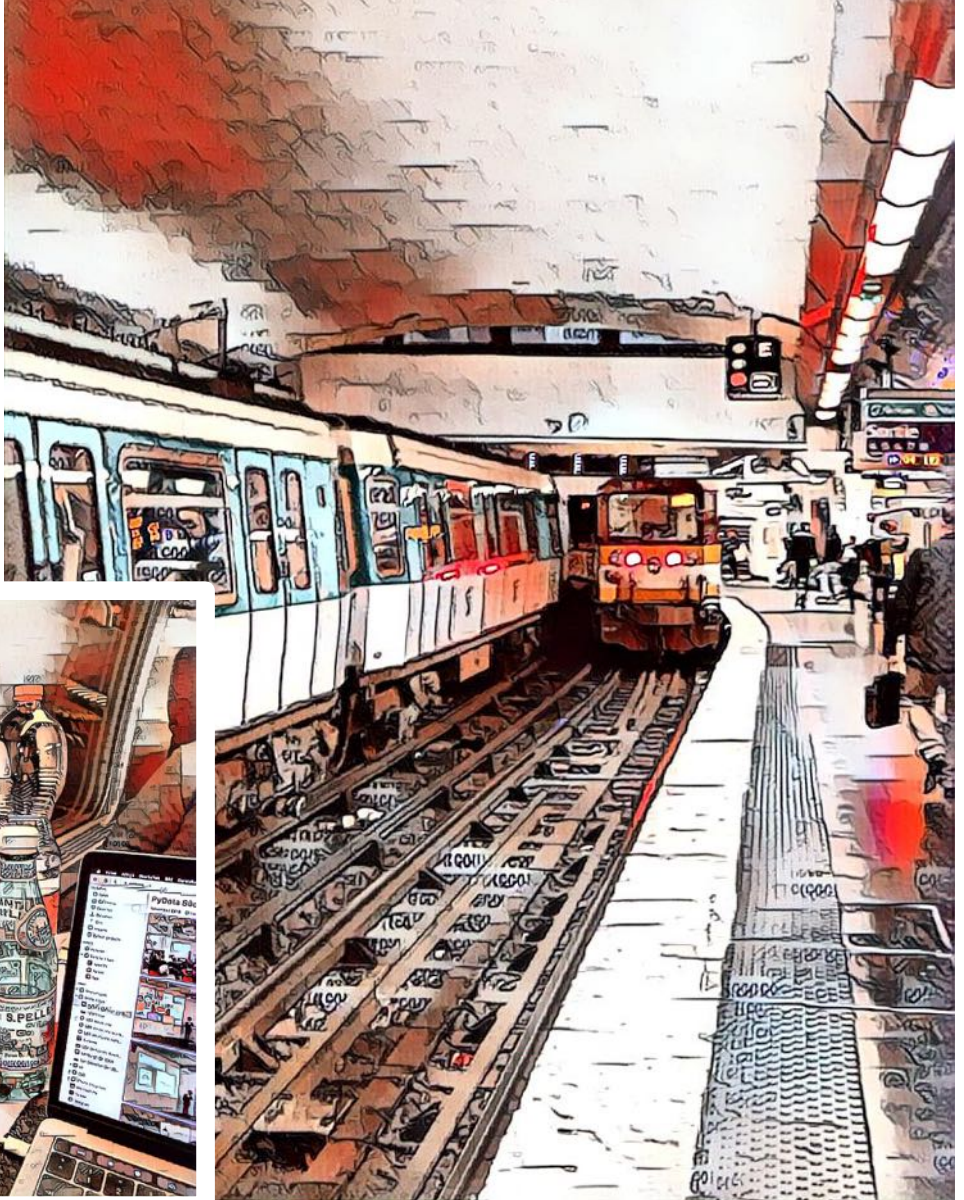
1

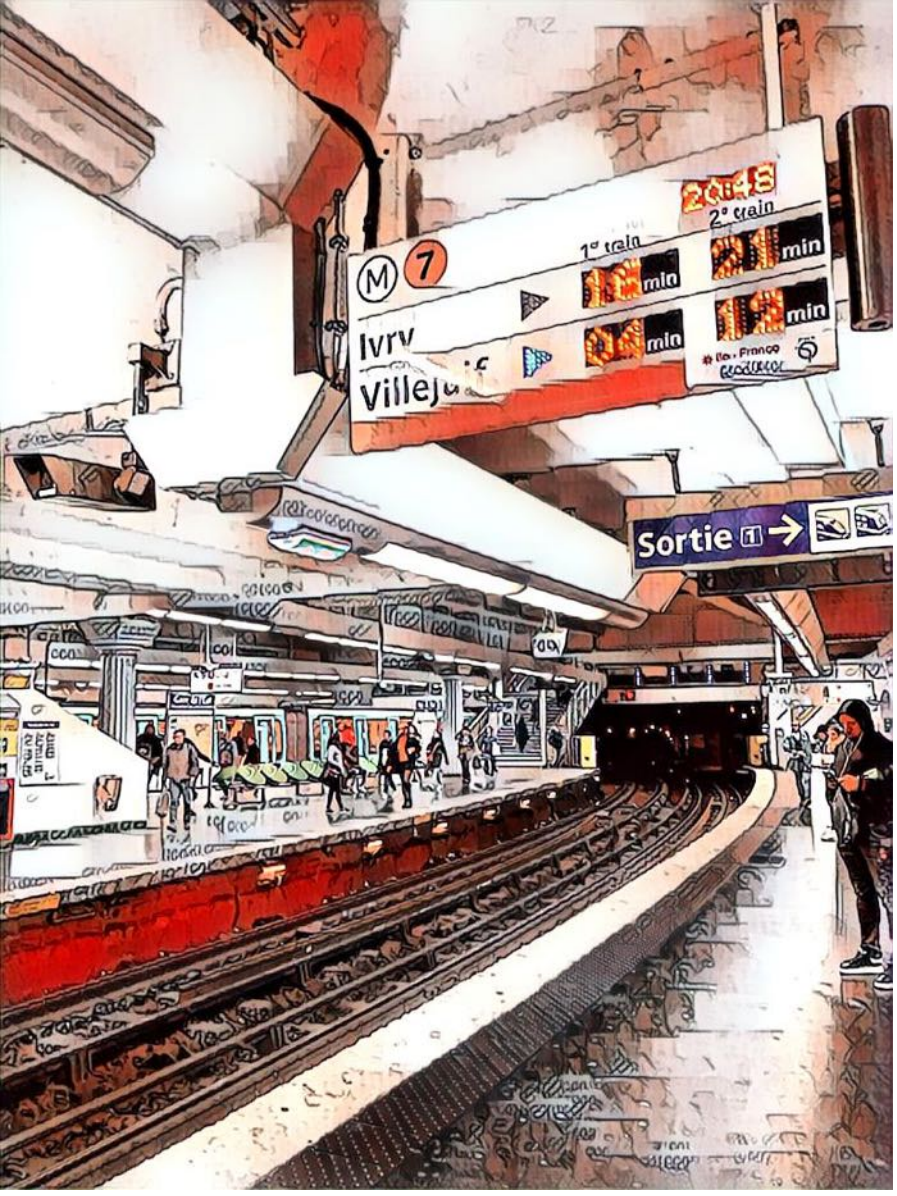
Thomas Rackow @TRackow · 27. Juli
Oh, i see. Even more amazing.

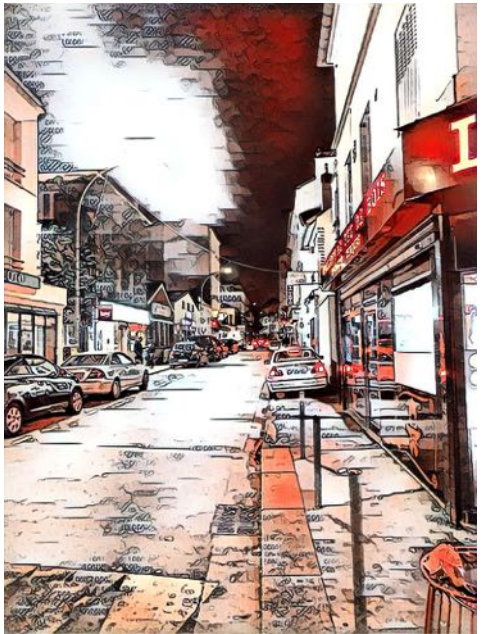
Tweet übersetzen


L'Empire des
PyParis



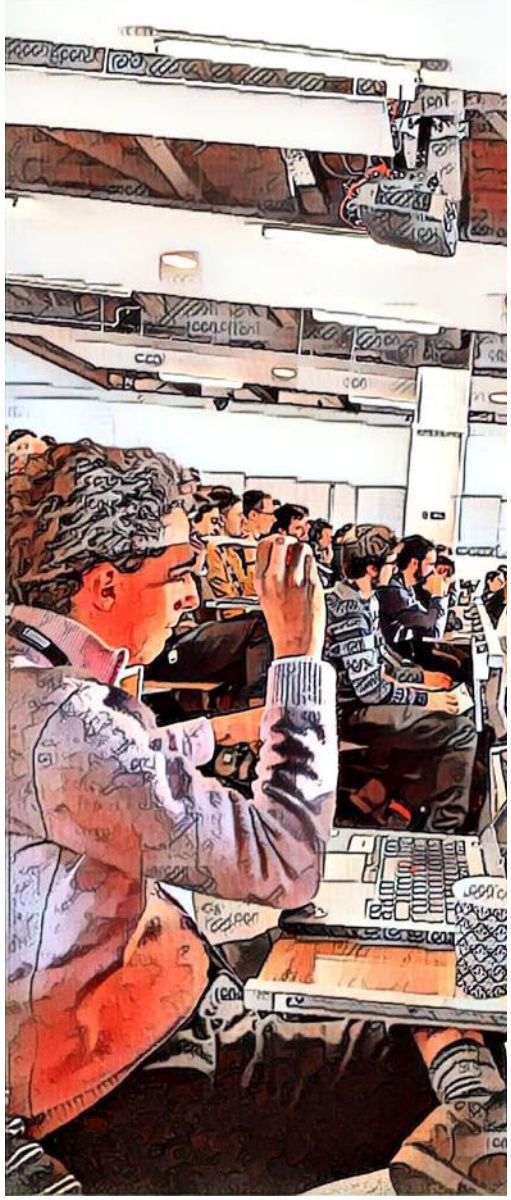



M 7
1° train
2° train
min
min
min
min
Sortie 1



VILLE
Mairie
DIB

THE PROGRAM COMMITEE
Nelie
Jules
Gael
Jean-Paul
Alexandre
Eric
Sebastien
Sylvain
Jill-Jenn
Stefane
Emmanuel
Systematic



Code Smells
10:28

11:04

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The Journey #2: The Vision

Die drei ???

- American juvenile detective book series „*The Three Investigators*"
- Investigations include mysteries of baffling phenomena (e.g. *whispering mummy*)
- 1964

- **Very** popular as books and radio dramas in Germany
- ~200 taped radio dramas (*Hörspiele*) published 1979 – today
- radio dramas have sold more than 45 million, the books ~ 16 million copies in Germany

Hörspiel?

- Taped radio drama
- Started in radio in the 1920ies
- Features:
  - Voice recordings
  - Natural or electroacoustic sounds,
  - Noises as well as silence
  - Cuts
  - Mixes
  - Music

Erzählen, Hörfunk Jarmila Mildorf 63ff.

Die drei ??? und die flüsternde Mumie

- Hörspielskript von FlukeSkywater –

Audio

Anfangsmusik

Im Hintergrund Arbeitslärm und Hundegebell.

Blacky Hilfe! Hilfe! Rettet mich! Hilfe!

Mathilda Justus! Du hast den Vogel zu viel fernsehen lassen. Er redet ja wie im Krimi. *(Papageiengekrächze)*

Justus *(schnauft)* Ganz recht, Tante Mathilda. Mmh, wo soll ich die Tür hin tun?

Mathilda Na, wohin schon? Zu den andern Türen natürlich. Los, ihr Burschen – ihr beiden auch! Bob, Peter – nu los doch!

Bob *(widerwillig)* Ja ...

Justus Die Arbeit ist schwer, Tante Mathilda. Wir könnten eine Pause gebrauchen.

Mathilda Aach, ich verstehe - ihr habt gesehen, dass die Post gekommen ist, und ihr seid neugierig. Ihr glaubt wohl, dass ein Brief für euch dabei ist.

Justus *(keucht)* Ist einer dabei, Tante Mathilda?

Die drei ???
Das Erbe des Meisterdiebes
103
EUROPA

Die drei ???
und die flüsternden Puppen
180
EUROPA

Die drei ???
und der seltsame Wecker
12
EUROPA

Die drei ???
und die flüsternde Mumie
10
EUROPA

Die drei ???
Das Grab der Inka-Mumie
EUROPA

Die drei ???
und die Perlenvögel
39
EUROPA

Die drei ???
und der riskante Ritt
51
EUROPA

Die drei ???
und der Karpatenhund
3
EUROPA

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Ingredients to be Synthesised

Story / Plot

- What's happening?

Dialogues

- Dynamic human speech

Cover

- Picture

Spoken Word

- Spoken Word by new and returning characters

Questions to Be Explored

- ***Resources required for individual steps***
  - **AI/Neural Network**
  - **Data acquisition / processing**
- ***Costs (& time)***
- ***Which** real **problems can we potentially solve in the future?***

The Journey #3: Realisation

- *transcripts / text sources to learn from*
- *recordings*

Technology Selection

- Local Lab eGPU ✅
- Ability to scale to cloud ✅
- Reproducibility & documentation of experiments ✅
- PyTorch ✅

PYTORCH

The Process

- *Data acquisition*
- *Data cleansing*
- *Research a paper / working solution*
- *Verify it's working*
- *Adapt the solution for our use case*
- *Maximize quality*

Text

- *Fabricate a text to be spoken by a character*

Andrej Karpathy blog

About Hacker's guide to Neural Networks

The Unreasonable Effectiveness of Recurrent Neural Networks

May 21, 2015

There's something magical about Re
recurrent network for Image Caption
arbitrarily-chosen hyperparameters)
the edge of making sense. Sometim
out of it blows past your expectation
time was that the common wisdom v
I've in fact reached the opposite cor
witnessed their power and robustne
This post is about sharing some of t

http://karpathy.github.io/2015/05/2

Shakespeare

It looks like we can learn to spell English words. But how about if there is more structure and style in the data? To examine this I downloaded all the works of Shakespeare and concatenated them into a single (4.4MB) file. We can now afford to train a larger network, in this case lets try a 3-layer RNN with 512 hidden nodes on each layer. After we train the network for a few hours we obtain samples such as:

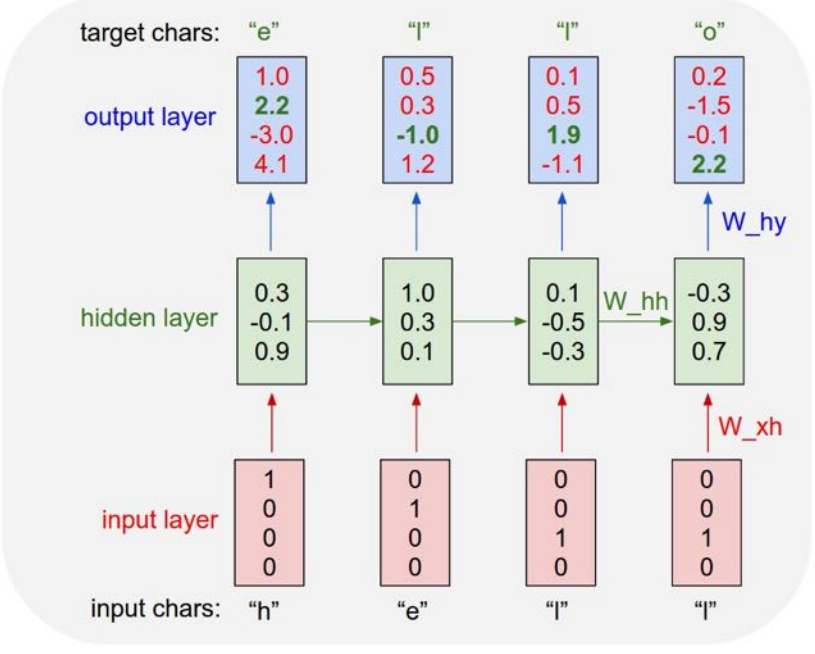
```
PANDARUS:
Alas, I think he shall be come approached and the day
When little srain would be attain'd into being never fed,
And who is but a chain and subjects of his death,
I should not sleep.

Second Senator:
They are away this miseries, produced upon my soul,
Breaking and strongly should be buried, when I perish
The earth and thoughts of many states.
```

Process

- Fan-made transcripts from PDF
- pre-processing with textract
  http://textract.readthedocs.io/en/latest/index.html
- Identify characters via names other fan page
  296 unique names identified
- German language, 1.521.382 words, 56.674 unique

Process

- Verified produced something *Shakespeary*
- Fed with the dialogue corpus



Results Character Based

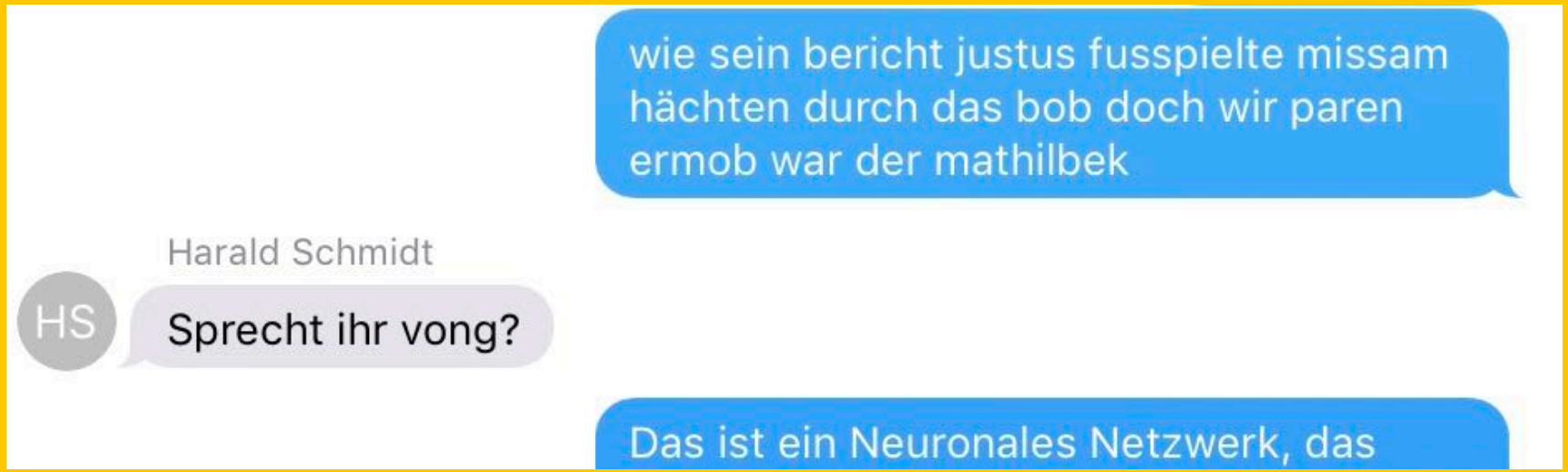
“wildes der prücks und nun bei sie redaste sich es hinden struch wenn hatten spielte schlokonianer lüst !”

“Wild of the pruecks and now they redaste themselves it had hunched when Schlokonianer lüst had played!”

(Google translate)

Results Character Based

-



Results: Word Based

“nicht zitrone dran schlammgrünen welcher peter ins all will”

"Not lemon on the mud green which peter wants in all"

“morton ist sich noch nicht einig einen wollt kerlen müssten”

“Morton is not yet agreed one would like to have Kerlen”

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Chat Bot To The Rescue?

-

https://arxiv.org/abs/1708.00818

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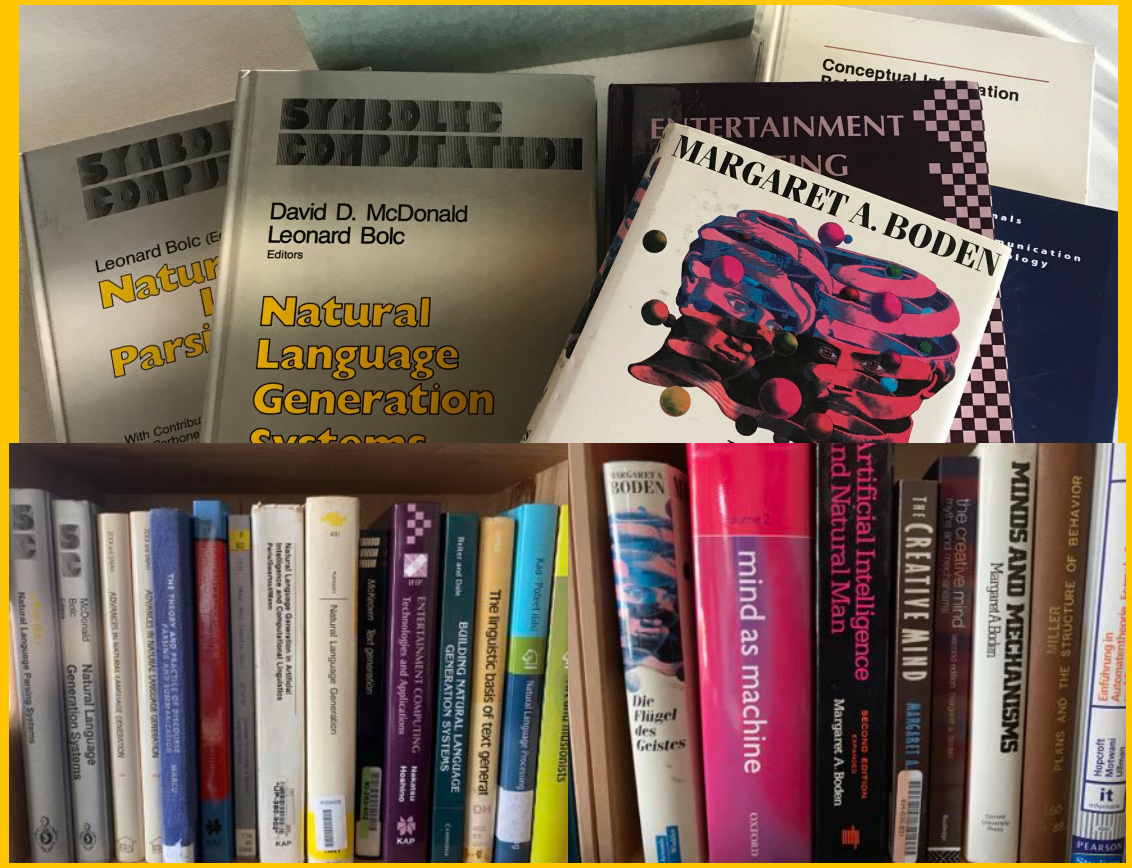
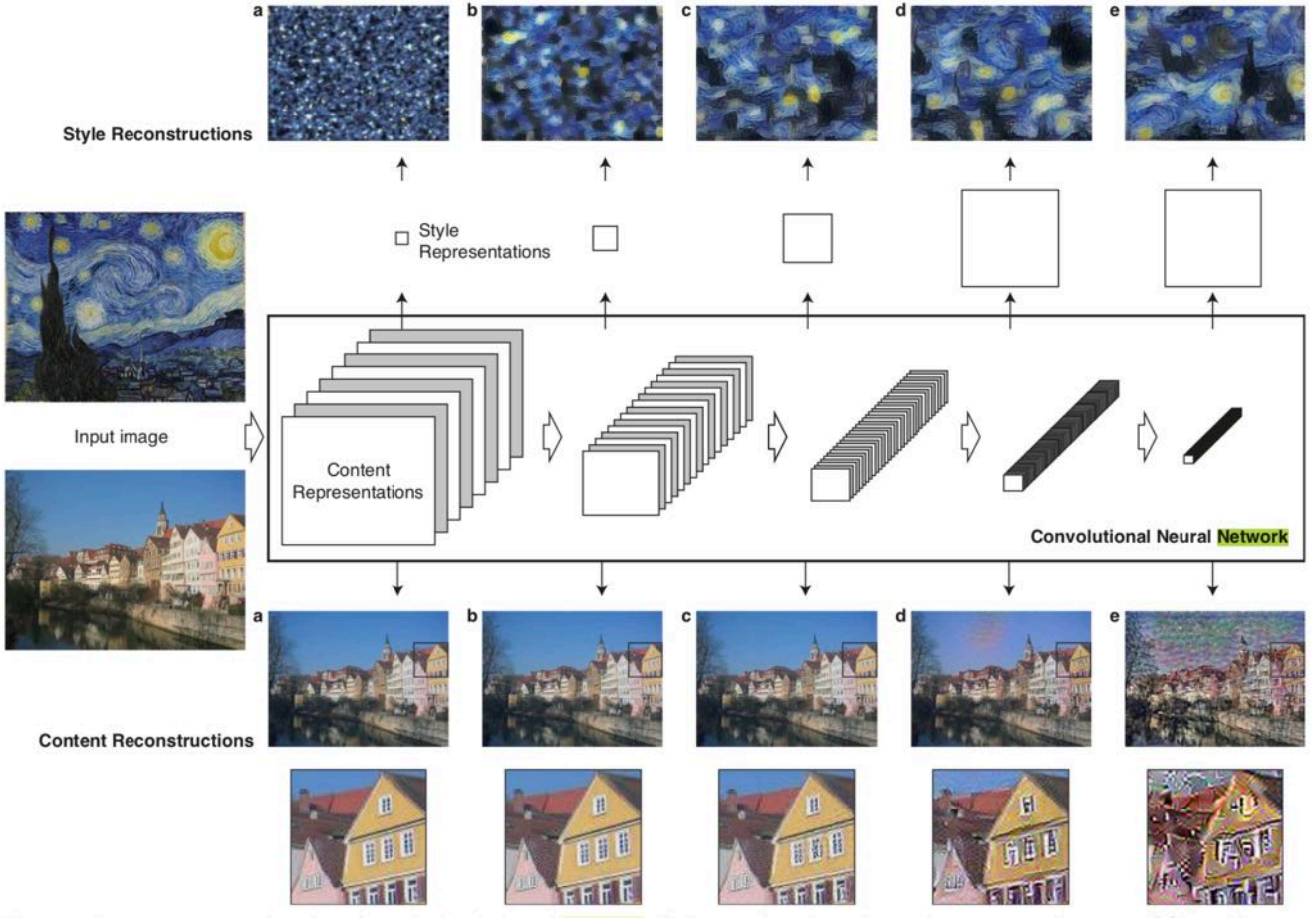
Text

-

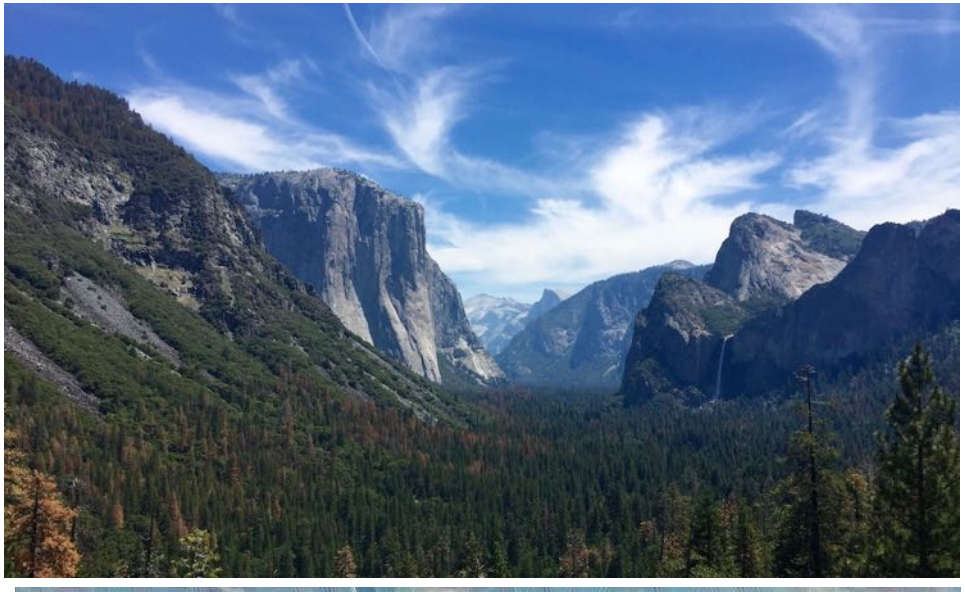


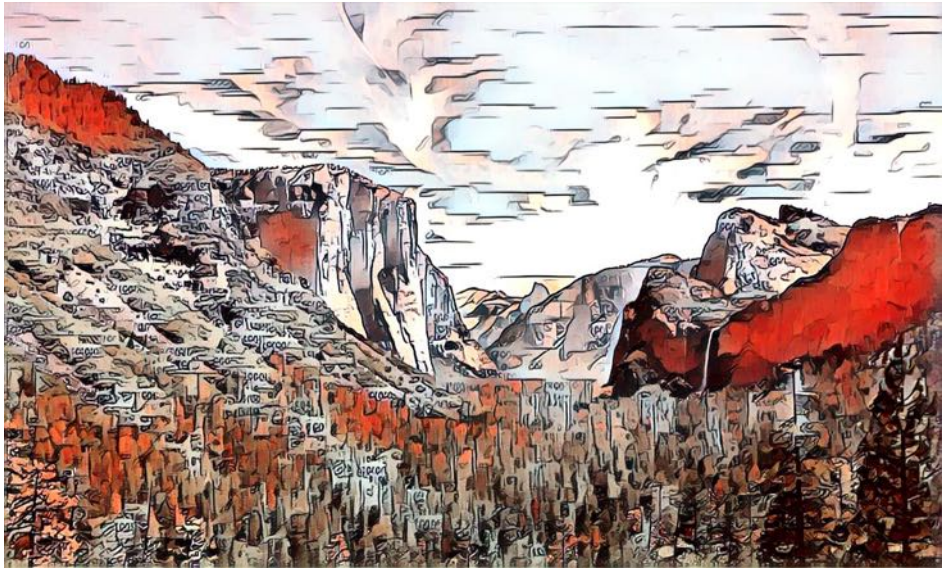
Artwork

- *Fabricate artwork meeting the style of the series*



A Neural Algorithm of Artistic Style
Leon A. Gatys, Alexander S. Ecker, Matthias Bethge, https://arxiv.org/abs/1508.06576





Die drei ???
und der Super-Papagei
1
EUROPA

Die drei ???
und die flüsternden Puppen
180
EUROPA

Die drei ???
und der seltsame Wecker
12
EUROPA

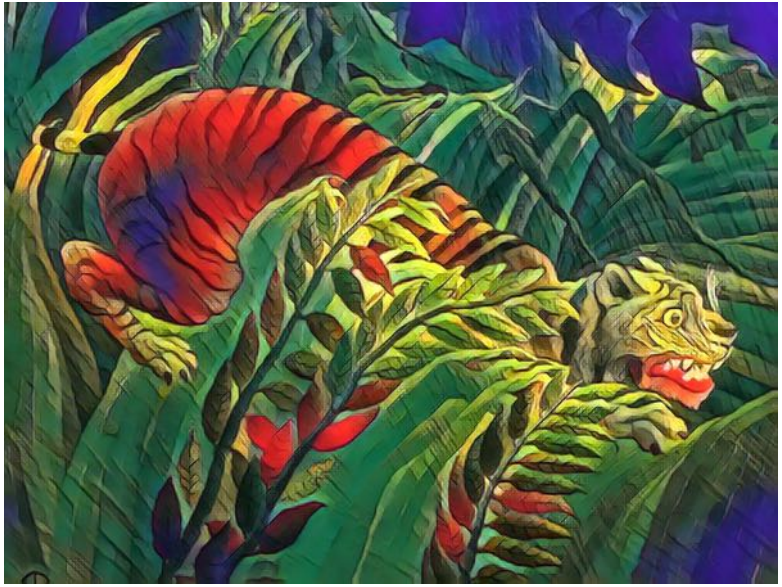
Die drei ???
und die flüsternde Mumie
10
EUROPA

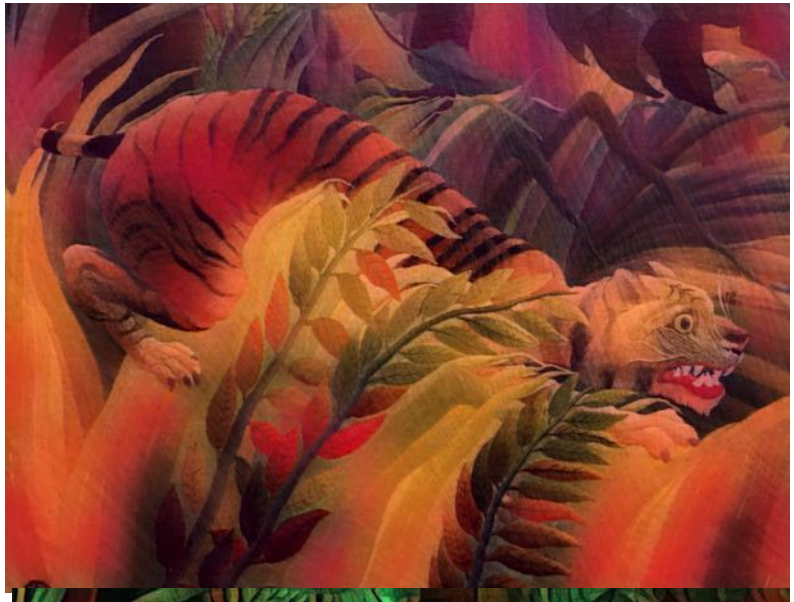
Die drei ???
Das Grab der Inka-Mumie
EUROPA

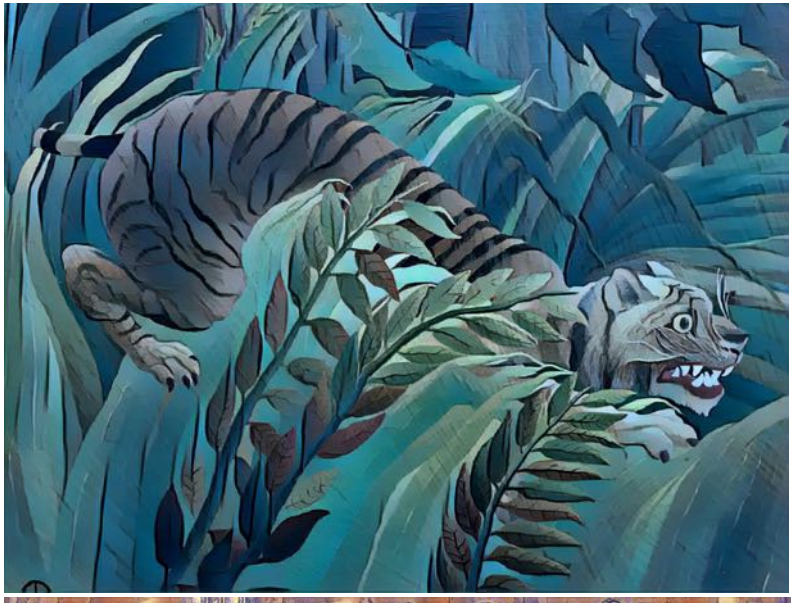
Die drei ???
und der verschollene Pilot
163
EUROPA

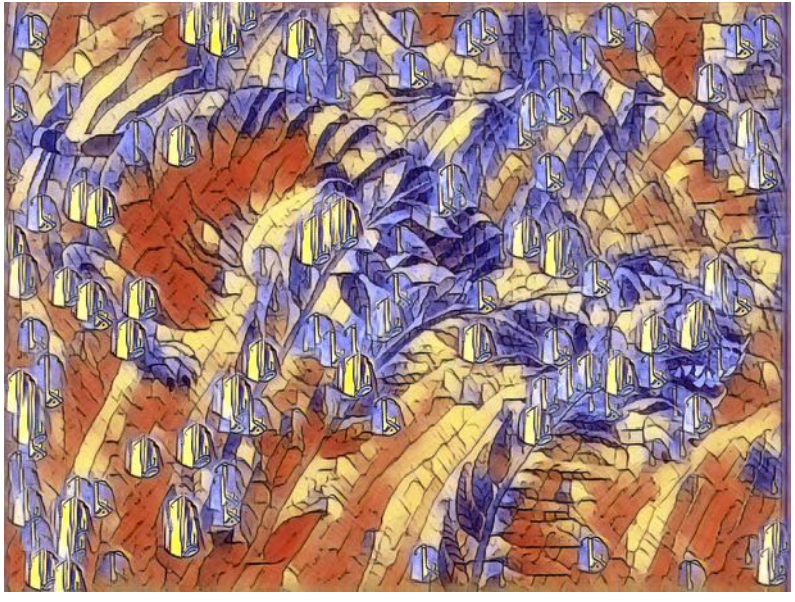
Die drei ???
und der riskante Ritt
51
EUROPA

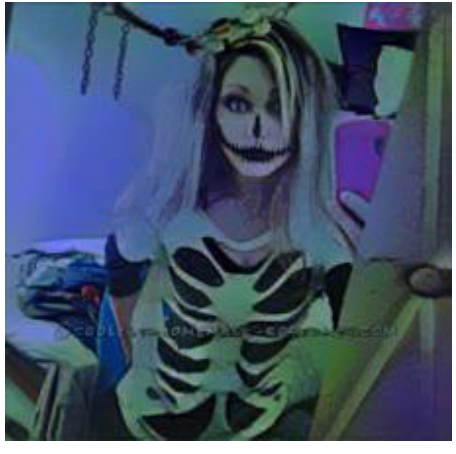
Die drei ???
und der Karpatenhund
3
EUROPA

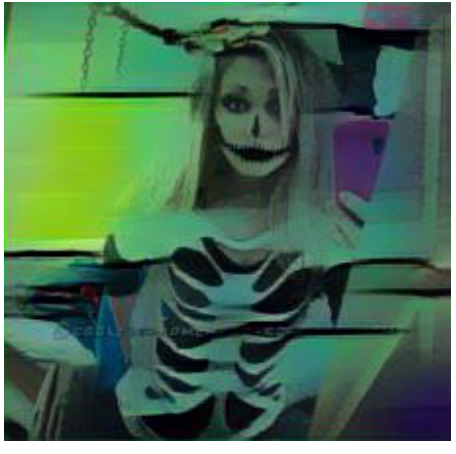


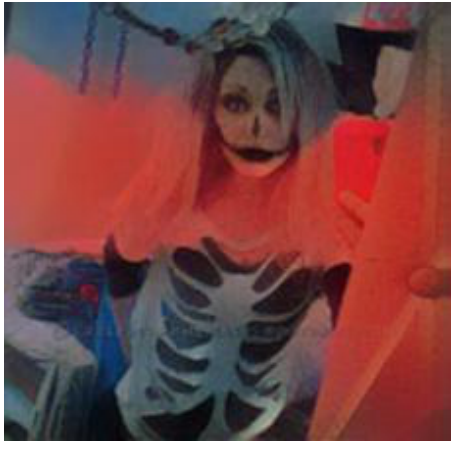


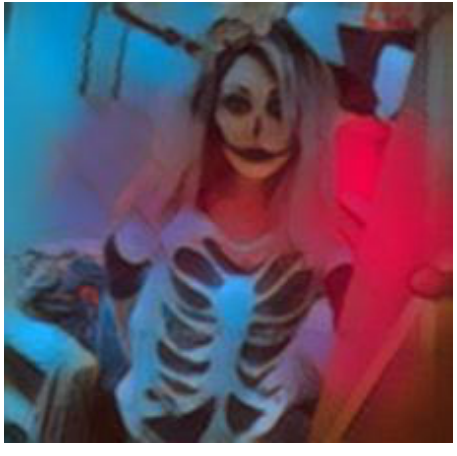








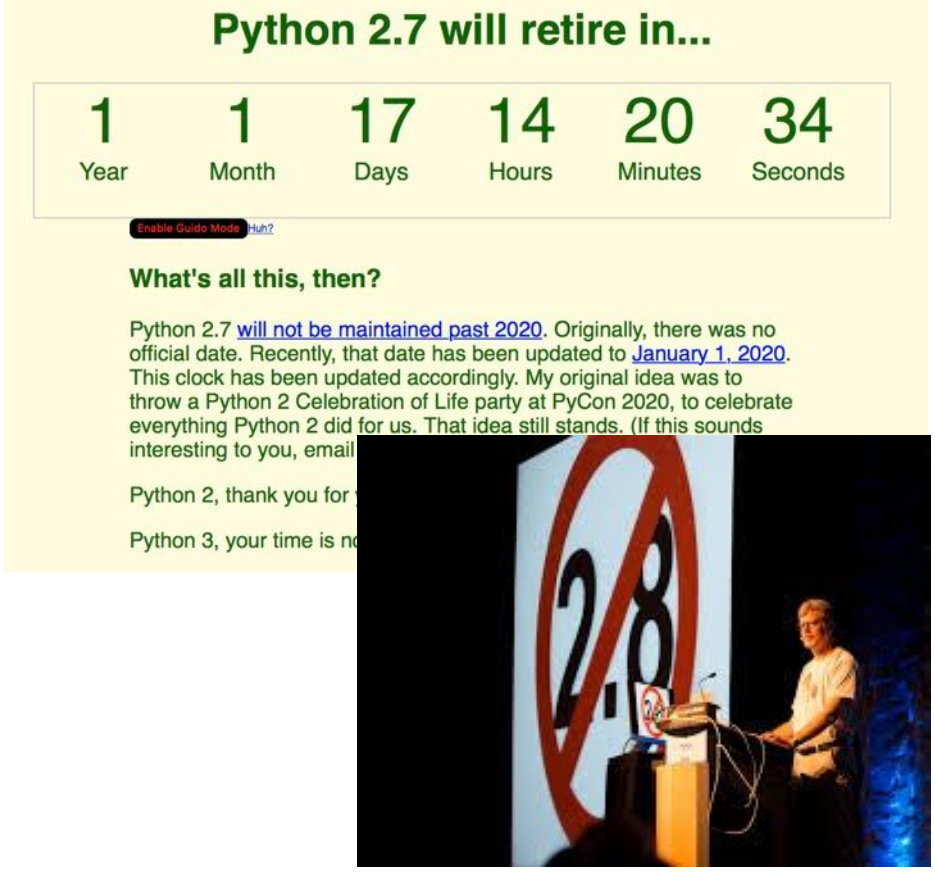




PyRand

Python Version

- Python 2.7 support ends by 2020
- All projects should really use Python 3 now



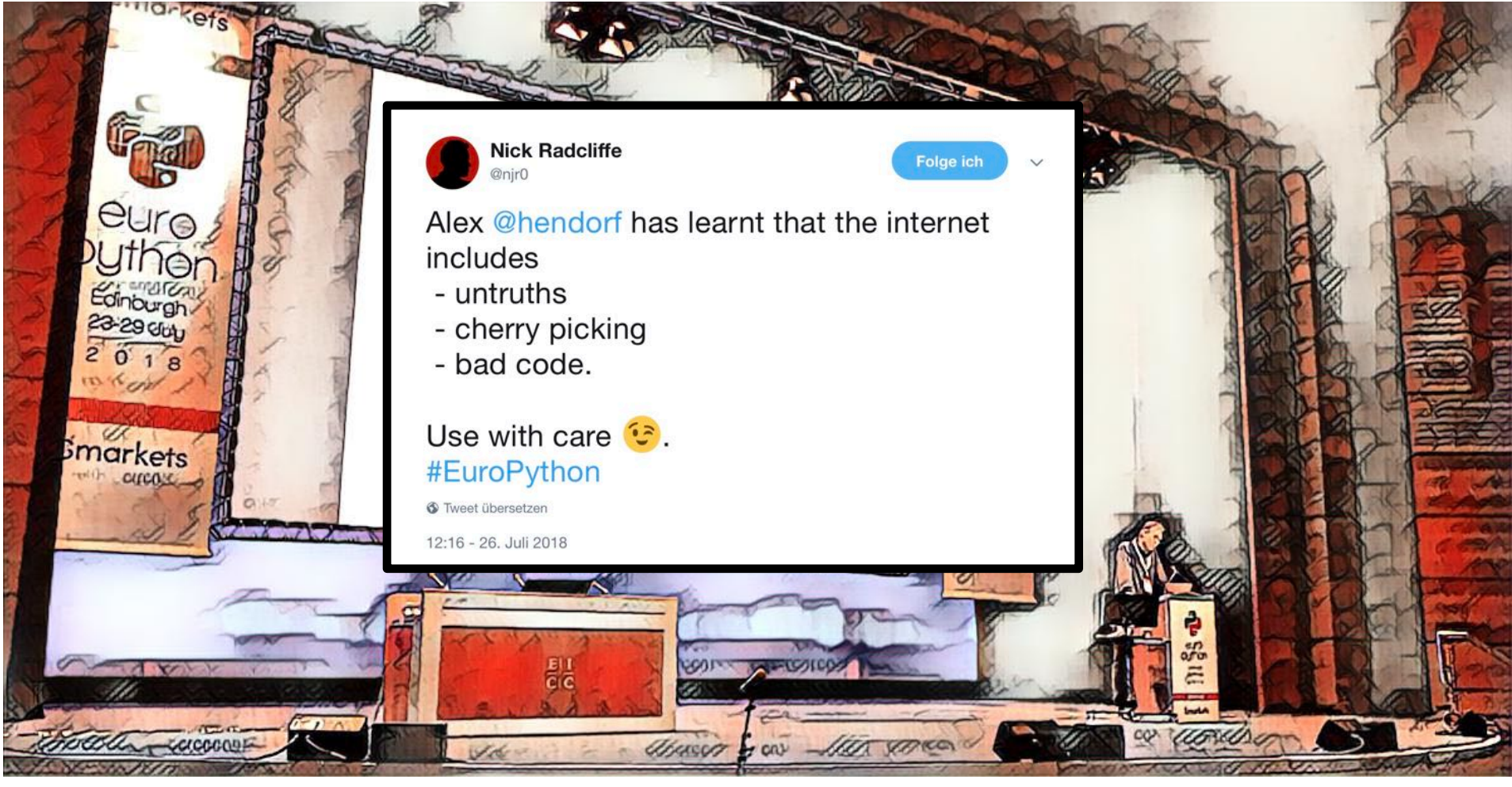
PyRand

Python Code Quality

- Keywords often used for variables, e.g.
  - input
  - in
  - list
  - > use _, e.g. _input
- Closures:
  functions reference variables outside the function

In [1]:
```
1  a = 2
2  b = 3
3
4
5  def mysuperfunction():
6      a = 100
7      input = a * b
8      return input
9
10 mysuperfunction()
```

Out[1]: 300


euro
python
Edinburgh
23-29 July
2018
markets
Nick Radcliffe
@njr0
Folge ich
Alex @hendorf has learnt that the internet includes
- untruths
- cherry picking
- bad code.
Use with care 😉.
#EuroPython
Tweet übersetzen
12:16 - 26. Juli 2018

KŌNIGSWEG

Updates!

-

Speech

- *Fabricate spoken language*
- *Make it sounds like a known character*

Process: Fabricate

- LJ Speech Dataset (English)
  https://keithito.com/LJ-Speech-Dataset
- Natural TTS Synthesis by Conditioning WaveNet on Mel Spectrogram Predictions, Jonathan Shen, Yuxuan Wang and Zongheng Yang et al.
- Tacotron2 implementation used:
  NVIDIA/tacotron2

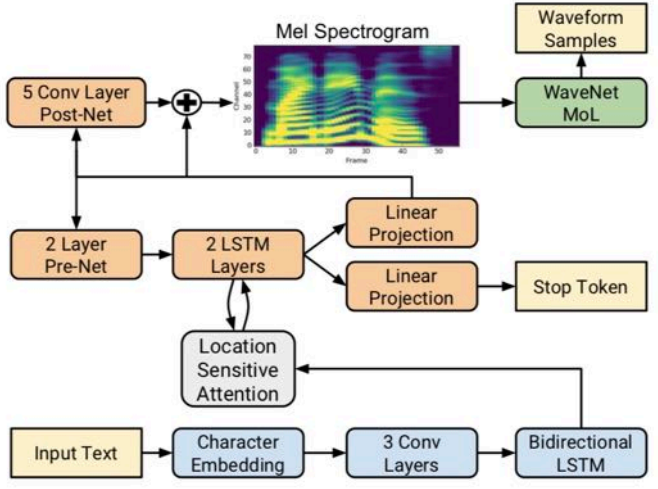
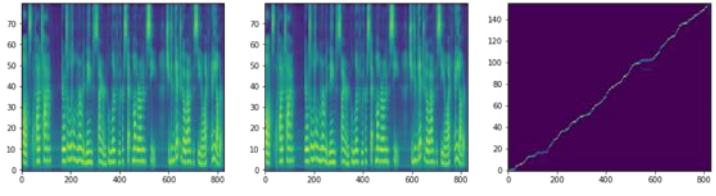


Fig. 1. Block diagram of the Tacotron 2 system architecture.



Training the Network

- *Requires:*
  - audio snippets and
  - text of the audio snippet

Once upon a time there was a little mermaid named Siren, who lived with her step mother under the sea, She didn't get to go out of the Sea like any other."

— 10 hrs

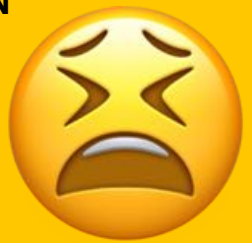
— 5 days

— 14 hrs

— 9 days

Let’s Do This in German!

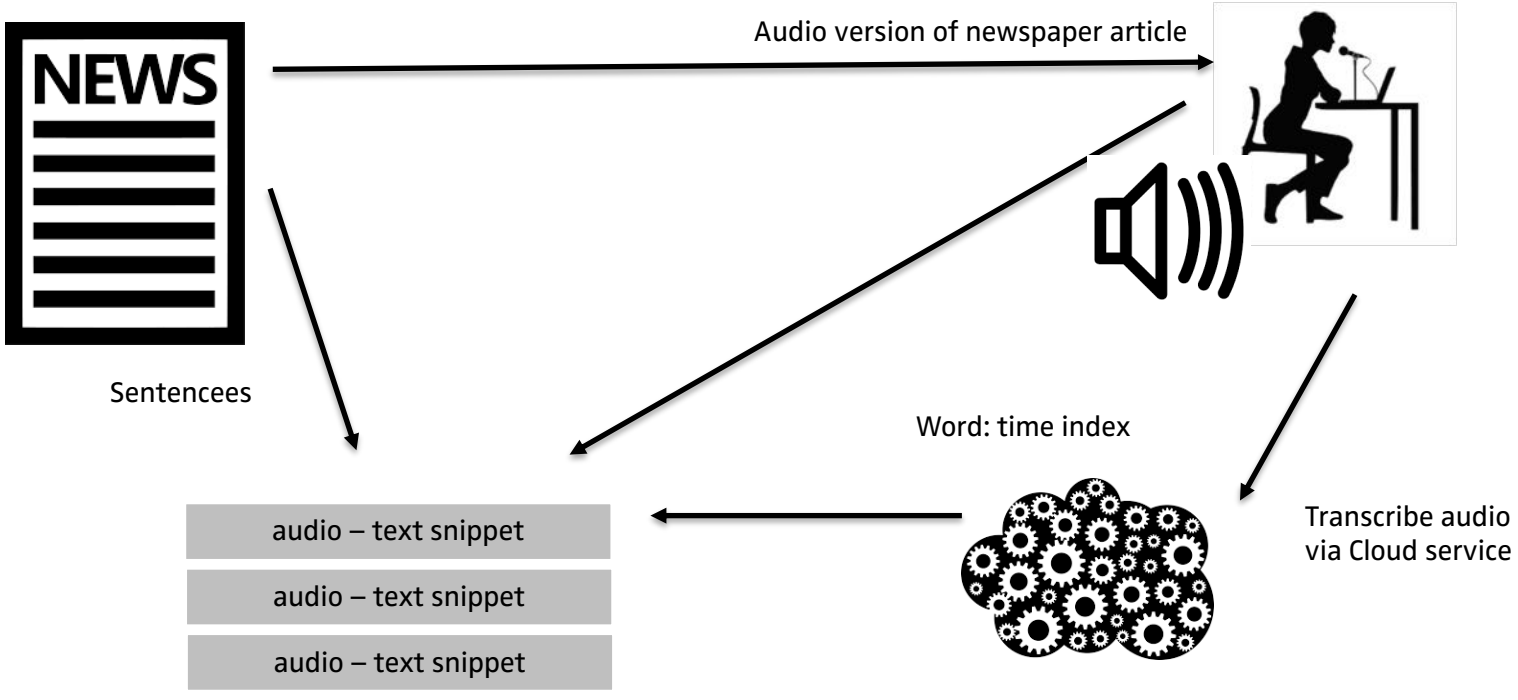
- *Requires:*
  - audio snippets and
  - text of the audio snippet
  - In GERMAN



We Can Do This in German!

- *Task: building a German corpus to learn with*
  - audio snippets
  - text of the audio snippet
- *Options*
  - audiobooks
  - newspapers with audio
  - …
- *Requirements*
  - humans to prepare the dataset

Semi-automation of Dataset Generation



Assumptions

1. Transciption service will deliver a very good quality
2. Transscription service a generally available at all providers and very cheap
3. It should be easy to generate a new corpus

KŌNIGSWEG

Assumptions

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Findings German

Quality is ok, but transcription is not accurate, many artefacts

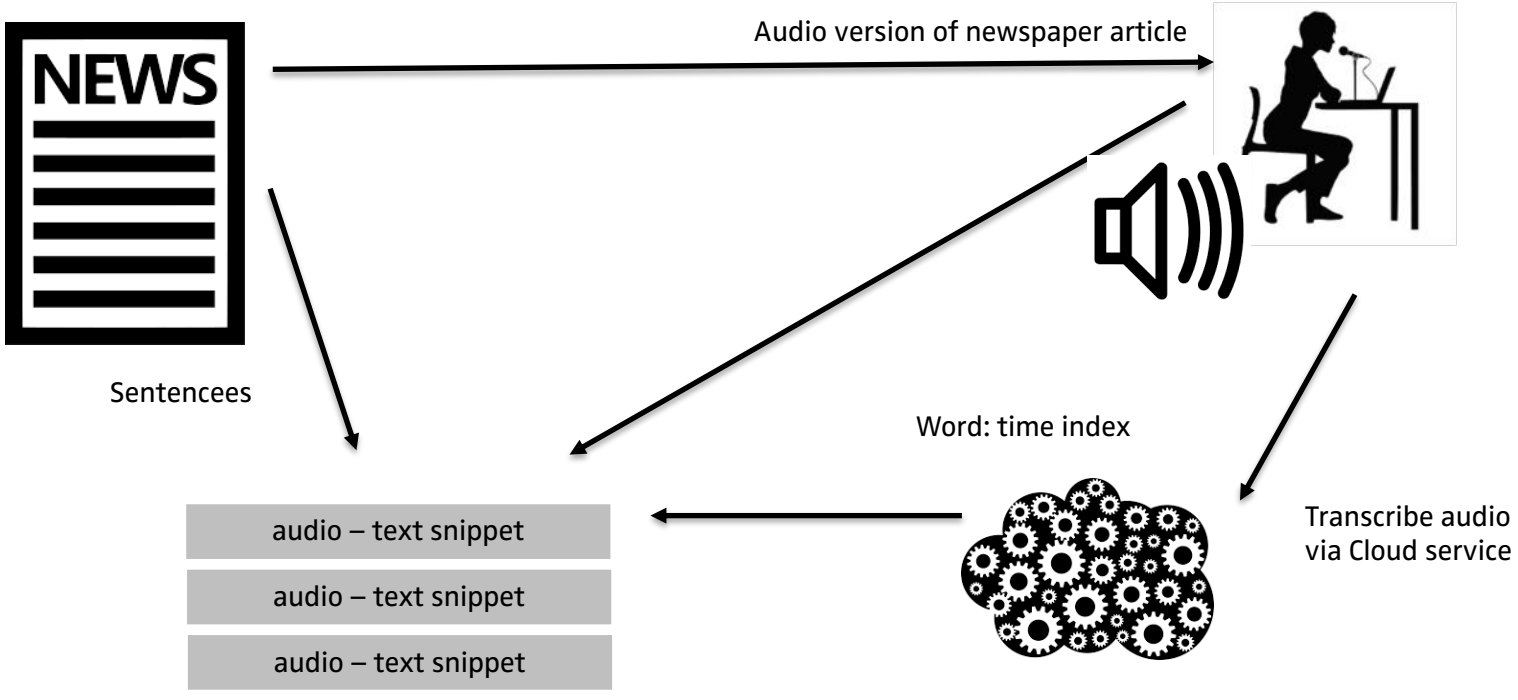
(+) Google (N/A) Azure (N/A) IBM (N/A) AWS Offline libs (-) Apple (-)

Not so simple...

The Dataset

- Newspaper article read by ~25 speakers
- Article text scraped from website

Semi-automation of Dataset Generation



KÖNIGSWEG

Deutschland darf kein Talent vergeuden, so heißt es immer wieder. Wo aber bleiben in unseren Schulen die Angebote für die besonders Talentierten?

Germany must not waste any talent, it is said again and again. But where are the offers for the most talented in our schools?

— ‘original’

— 10 days

— 14 hrs

— 14 days

Challenges

Lessons learned

Assumptions

1. Neural Networks are hard to set up
2. Neural Networks are hard to train
3. Neural Networks are smart
4. Data is like the new Oil
5. The singularity is coming 2045 (Ray Kurzweil)

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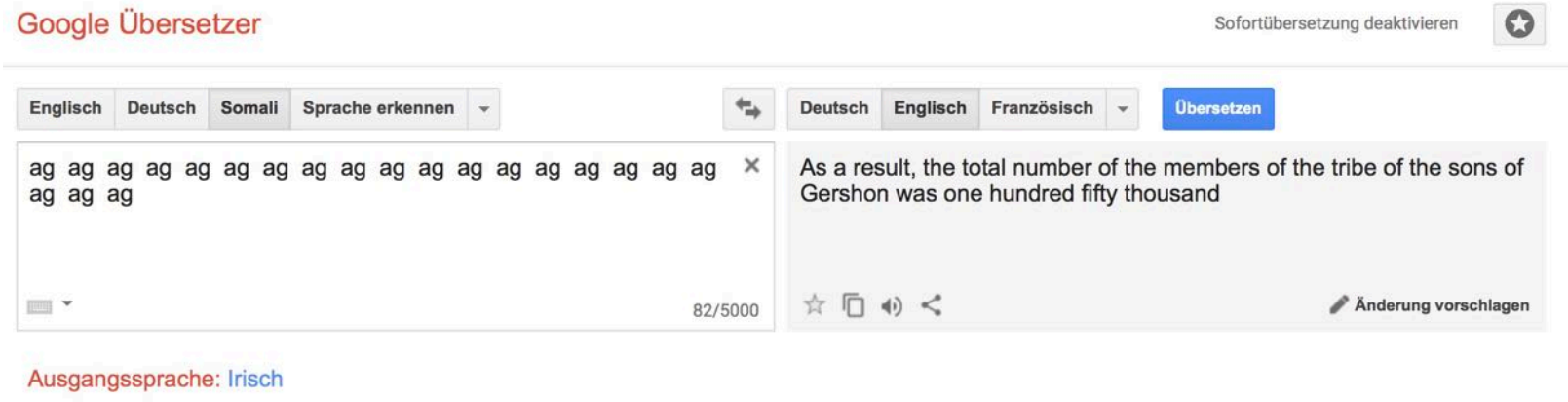


https://translate.google.com/#so/en/ag%20%20ag%20%20ag%20%20

Emilien Dupont

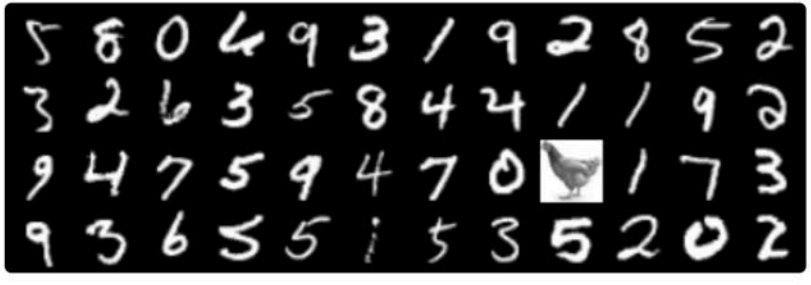
Machine Learning

Passing a Chicken through an MNIST Model

14 Mar 2018

When you put a picture of a chicken through a model trained on MNIST, the model is 99.9% confident that the chicken is a 5. That's not good.

This problem does not just relate to chickens and digits but the fact that a neural net makes very confident predictions on data that does not come from the same distribution as the training data. While this example is artificial, it is common in practice for a machine learning model to be used on data that is very different from the data it was trained on. A self-driving car, for example, may encounter an unusual environment that was never seen during training. In such cases, the system should not be overly confident but instead let the driver know that it is not able to make a meaningful prediction.[1]



Images from MNIST and a chicken.

https://emiliendupont.github.io/2018/03/14/mnist-chicken/

Breaking Linear Classifiers on ImageNet

Mar 30, 2015

You've probably heard that Convolutional Networks work very well in practice and across a wide range of visual recognition problems. You may have also read articles and papers that claim to reach a near *"human-level performance"*. There are all kinds of caveats to that (e.g. see my G+ post on Human Accuracy is not a point, it lives on a tradeoff curve), but that is not the point of this post. I do think that these systems now work extremely well across many visual recognition tasks, especially ones that can be posed as simple classification.

Yet, a second group of seemingly baffling results has emerged that brings up an apparent contradiction. I'm referring to several people who have noticed that it is possible to take an image that a state-of-the-art Convolutional Network thinks is one class (e.g. "panda"), and it is possible to change it almost imperceptibly to the human eye in such a way that the Convolutional Network suddenly classifies the image as any other class of choice (e.g. "gibbon"). We say that we *break*, or *fool* ConvNets. See the image below for an illustration:

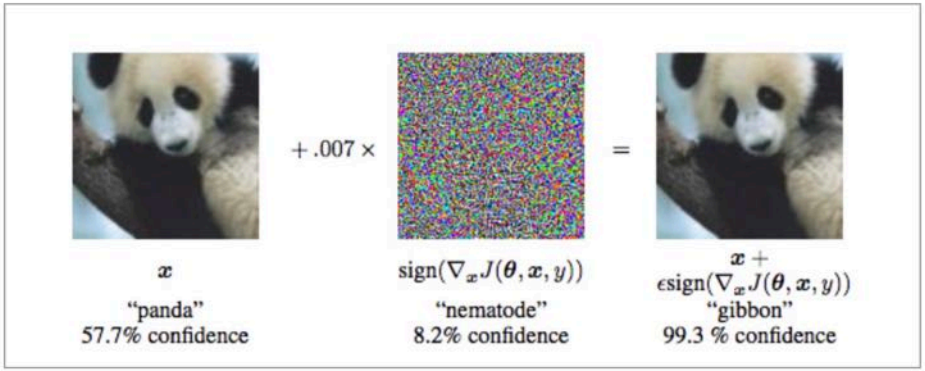


Figure from Explaining and Harnessing Adversarial Examples by Goodfellow et al.

Th**http://karpathy.github.io/2015/03/30/breaking-convnets/** et al. last year. They had a very similar set of images:

Assumptions

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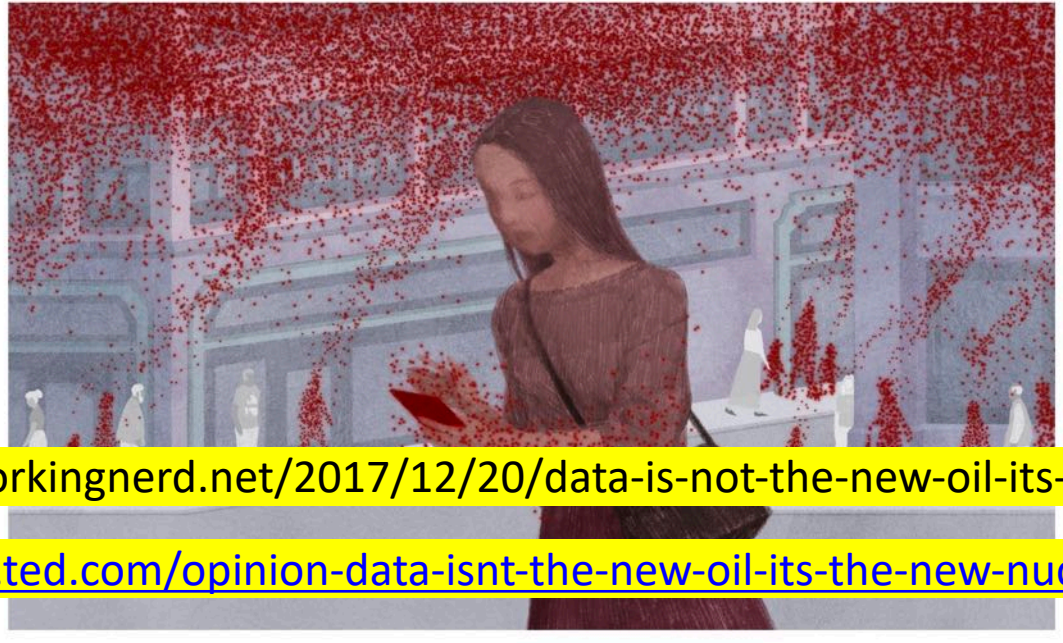
Opinion: Data isn't the new oil — it's the new nuclear power

Data is a valuable, powerful commodity — but unlike oil, it is unlimited in quantity and in its capacity for harm, says technology thinker James Bridle.

James Bridle



https://networkingnerd.net/2017/12/20/data-is-not-the-new-oil-its-nuclear-power/

https://ideas.ted.com/opinion-data-isnt-the-new-oil-its-the-new-nuclear-power/

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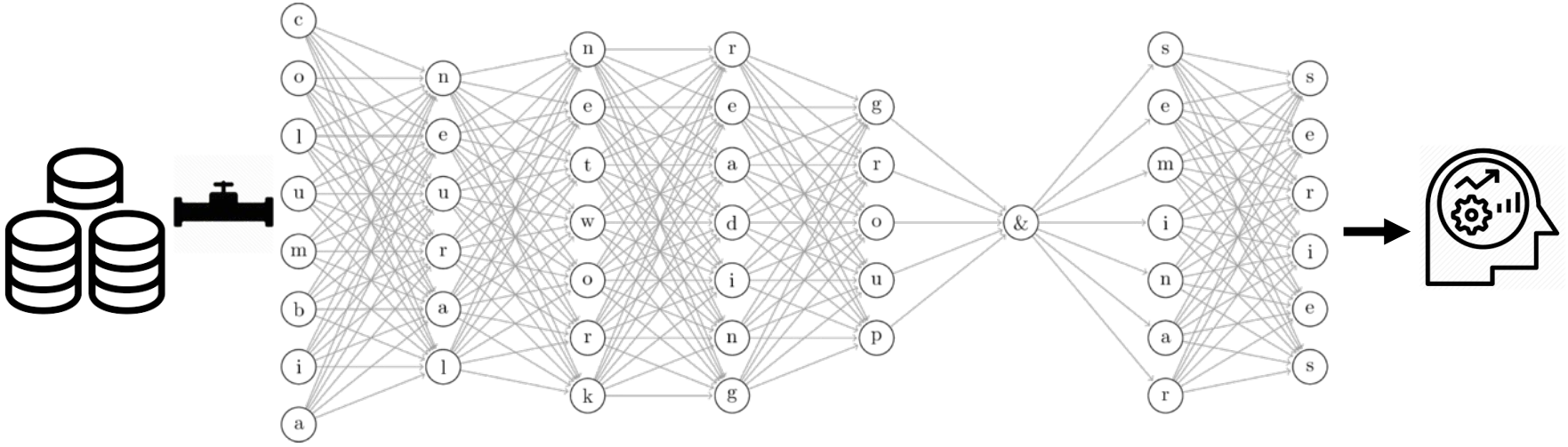
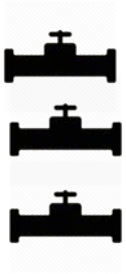
Managing Expectations on Resources Required



DATA | AI / NETWORK | MODELS

Reality Resources Required



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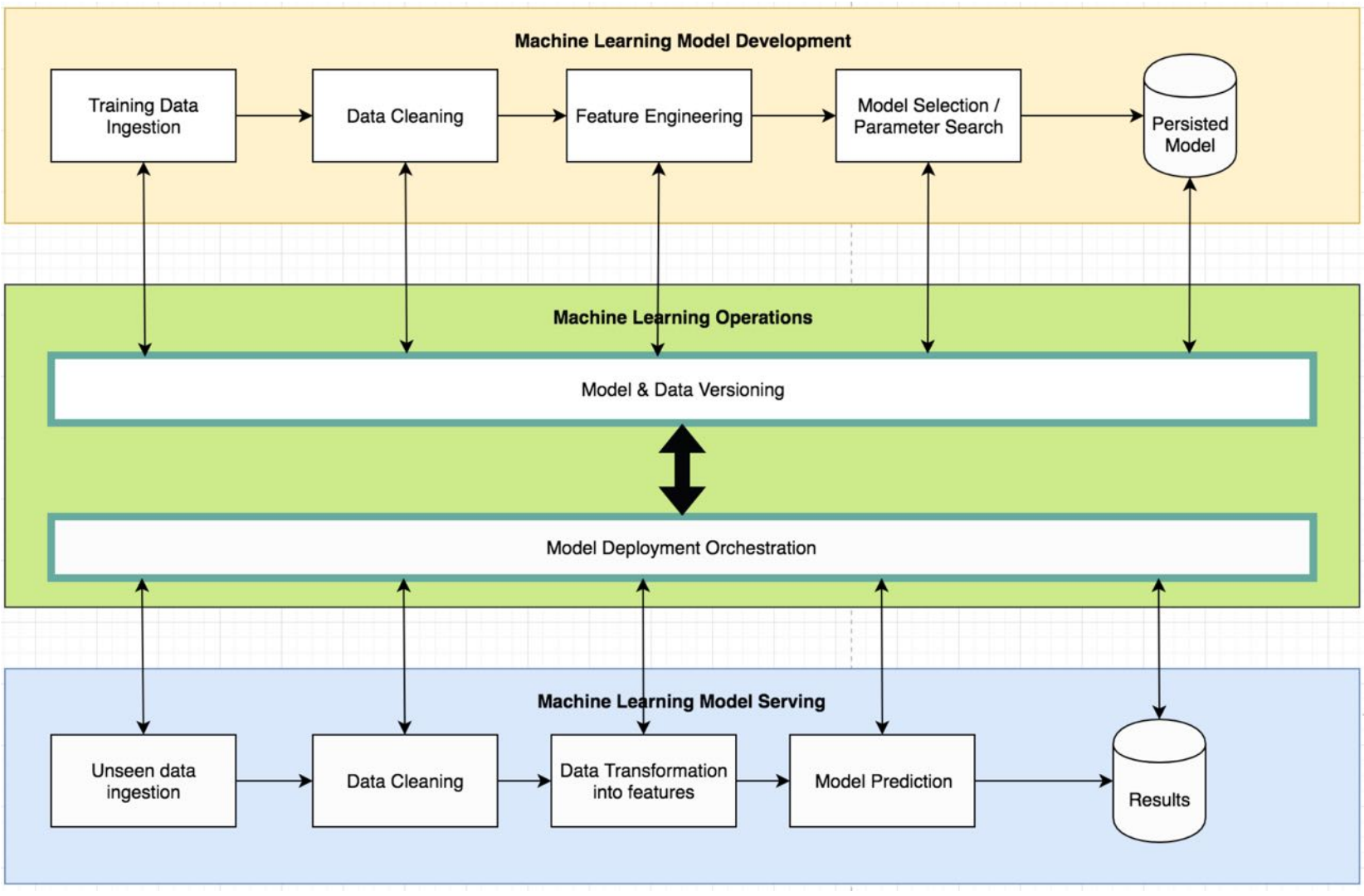
Machine Learning Model Development
Training Data Ingestion
Data Cleaning
Feature Engineering
Model Selection / Parameter Search
Persisted Model
Machine Learning Operations
Model & Data Versioning
Model Deployment Orchestration
Machine Learning Model Serving
Unseen data ingestion
Data Cleaning
Data Transformation into features
Model Prediction
Results

fast.ai

Making neural nets uncool again

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Posts by Topic

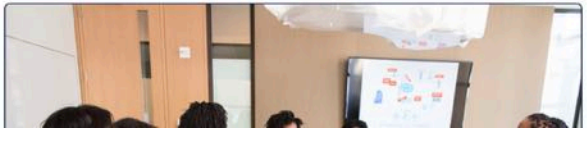
What do machine learning practitioners actually do?

Written: 12 Jul 2018 by *Rachel Thomas*

This post is part 1 of a series. Part 2 is an opinionated introduction to AutoML and neural architecture search, and Part 3 looks at Google's AutoML in particular.

There are frequent media headlines about both the **scarcity of machine learning talent** (see here, here, and here) and about the promises of companies **claiming their products automate machine learning** and eliminate the need for ML expertise altogether (see here, here, and here). In his keynote at the TensorFlow DevSummit, Google's head of AI Jeff Dean estimated that there are **tens of millions** of organizations that have electronic data that could be used for machine learning but **lack the necessary expertise and skills**. I follow these issues closely since my work at fast.ai focuses on enabling more people to use machine learning and on making it easier to use.

In thinking about how we can automate some of the work of machine learning, as well as how to make it more accessible to people with a wider variety of backgrounds, it's first necessary to ask, *what is it that machine learning practitioners do?* Any solution to the shortage of machine learning expertise requires answering this question: whether it's so we know what skills to teach, what tools to build, or what processes to automate.



http://www.fast.ai/2018/07/12/auto-ml-1/

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3. ~~Neural Networks are smart~~ Neural Networks are blinkered specialists
4. ~~Data is like the new Oil~~ Please stop saying this
5. The singularity is coming 2045 (Ray Kurzweil)

Machines do not care

Interview with Margaret Boden in German Zeit Magazine (top 5 national newspaper)

Assumptions

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"Maschinen ist alles egal" – Ir

https://www.zeit.de/zeit-magazin/2018/36

ZEITmagazin: Many contemporaries see these advances with concern. They are frightened of a world where machines dominate people. The inventor and futurologist Ray Kurzweil, now director of technical development at Google, even claims that **superhuman artificial intelligence is near**. Around the year 2045, it will become reality. Do you believe him?

Boden: I asked him if he actually believes what he writes.

ZEITmagazin: And?

Boden: He really believes it.

ZEITmagazin: Can you dismiss Kurzweil as a spinner?

Boden : no. He has done an extraordinary job for the advancement of technology. I use the word genius very rarely. With Kurzweil I would be ready for it. Maybe someday there will be an artificial intelligence superior to us. But certainly not in this century. Things are a lot more complicated than people imagine. Kurzweil's prediction is just crazy.

AI vs. Marketing B-Bingo

Siemens Careers @SiemensCareers · 19. Sep.

Das "AI Lab" ist ein besonderer Siemens-Standort: Im Coworking Space am Viktualienmarkt bringen Ulli und sein internationales Team Robotern das Denken bei. Lerne Ulli und sein Team kennen: sie.ag/2NiWnGN
#FutureMakers

20 48 287

Alexander CS Hendorf @hendorf · 21. Sep.

Maschinen denken nicht, vielleicht mag Ulli das mal seinen Kollegen erklären.

2 5

Ulli Waltinger
@ulliwaltinger

Folgen

Antwort an @hendorf @SiemensCareers

Alexander - hast recht 🤓 wir entwickeln Software, welche in unterschiedlichen Systemen implementiert oder embedded wird.

Next Steps

- Look into story generation
- Training a better model for German ???-like text
- Improving speech synth by adding more data
- Multi-style transfer
- Auto selection of good models
- Data pre-tuning to optimize output
- Scene agnostic (sub)-style selection

Summary

Are Neural Networks great and useful?

Summary

Are Neural Networks great and useful?

Of course they are!

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Thank you!

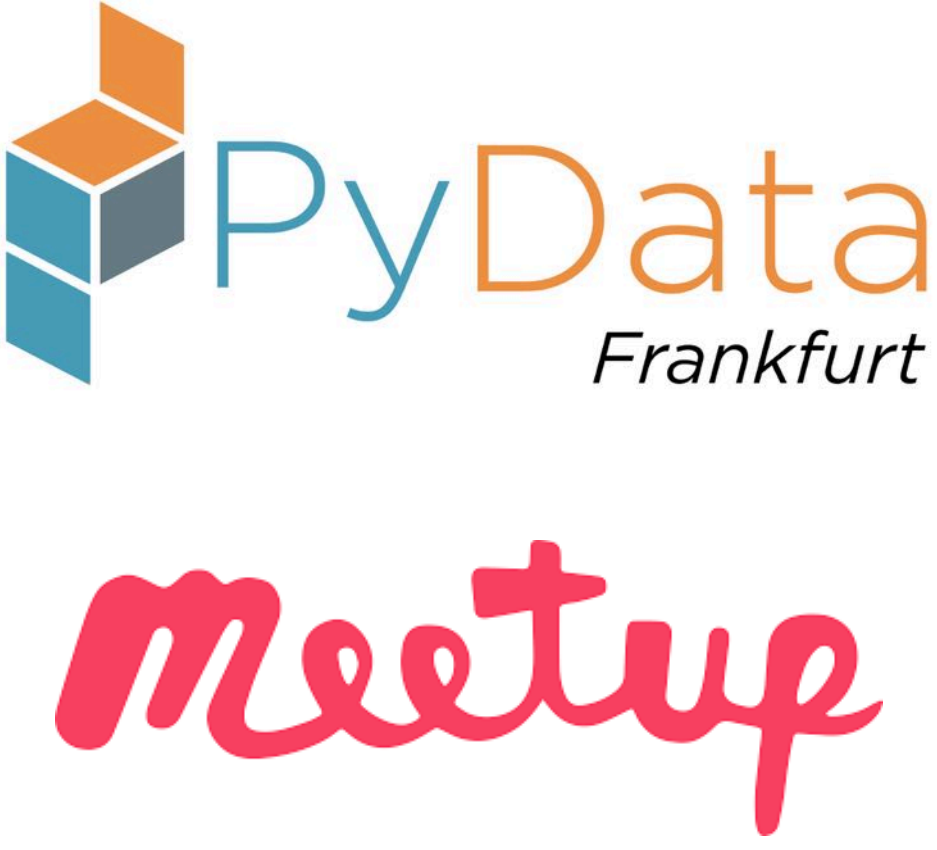
Q & A

We're hiring

koenigsweg.com

ah@koenigsweg.com

@hendorf


PyData
Frankfurt
meetup

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