Deep Learning

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Greetings

Safe and Healthy

- Welcome to a new semester, a new method of learning
- Welcome to the newly admitted Ph.D and M. Tech students of CSE, Data Science and non-CSE departments
- Previous semester all of us have taken this mode of learning all of a sudden
- We may have had our limitations. We are successful in adopting the mode of learning
- This complete semester is online method of teaching and learning. We were informed well in advance. Yet newer adoptation methods are required

Outline

Theory

- Course Instructors
- About CS590
- What to expect?
- Text books/Resources
- Pre-requisites
- Evaluation model
- Grading policy
- Re-evaluation policy

Course Instructors

Instructors

- Dr. Vijaya Saradhi (First part)
- Invited lectures (Second part)
- Dr. Sanasam Ranbir Singh (Third part)

About CS590

Syllabus

- Machine learning basics
- Deep networks
- Background
- CNN
- Different CNN models
- Sequence learning
- Generative modeling
- Zero shot learning
- Applications for natural language processing: data embedding

What to Expect?

From The Material

- This is a theory course
- Do I need a powerful machine to credit this course?
- Do I have hands on experience about the deep learning models?
- Algorithmic perspective of neural networks and deep learning methods
- Introduce you to application specific learning architectures
- Applications in computer vision, natural language processing
- First part - building the background predominantly neural networks
- 2^{nd} and 3^{rd} part cover advanced concepts
- Computer vision applications and natural processing applications

CS590: Books

Text Books

- Simon Haykin Neural Networks and Learning Machines, Pearson Prentice Hall, 2009 `dai.fmph.uniba.sk/courses/NN/haykin.neural-networks.3ed.2009.pdf`
- Ian Goodfellow, Yoshua Bengio and Aaron Courville Deep Learning, An MIT Press Book `https://www.deeplearningbook.org/`

CS590: Video Resources

Video Lectures

- Video links from https://www.deeplearningbook.org/lecture_slides.html
- General: Neural Networks https://www.youtube.com/watch?v=aircAruvnKk
- General: Gradient descent https://www.youtube.com/watch?v=IHZwWFHWa-w
- General: Back propagation https://www.youtube.com/watch?v=tIeHLnjs5U8
- Hands on: Tensorflow https://nptel.ac.in/courses/106/106/106106213/
- Hands on: Introduction to Tensors https://nptel.ac.in/courses/106/106/106106213/
- Hands on: Tensorflow part 1: https://nptel.ac.in/courses/106/106/106106213/
- Hands on: Tensorflow part 2: https://nptel.ac.in/courses/106/106/106106213/
- Hands on: Tensorflow part 3: https://nptel.ac.in/courses/106/106/106106213/

CS590: Pre-requisites

Pre-requisites - None; however background material is required

Background material

1. Optimization
   - Unconstrained multi-variable optimization
   - Constrained multi-variable optimization
2. Linear Algebra
   - Vector spaces
   - Norms

CS590: Evaluation Model

- Maximum of four assessments
- Each assessment carry equal weightage
- Nature of assessment is decided by the instructor; Multiple choice/short answer/long answers/etc.
- Saturday class will be either hands on class
- As and when there is hands on you will be informed well in advance
- For first part of the course I strongly encourage you to go through the Hands on videos on Tensorflow. The links are given in the Video resources slide

CS590: Grading and Re-evaluation Policy

- Marks will be uploaded in the Microsoft teams assignment module
- Relative grading is followed
- In case of any issue with the evaluation do point out the same through email within a week of obtaining marks.
- Re-evaluation will be conducted and will be informed to you.
- No re-re-evaluation is entertained.

Strength of the course

Help from you required

- Course strength is huge with more than 250 students crediting
- Varying backgrounds: PhD, M. Tech, B. Tech of CSE and non-CSE
- Request you to channel your queries through course TAs

156101006	Brijesh Singh	brijesh.singh	PhD
176101005	Prasen Sharma	kumar176101005	PhD
186101001	Anirban Lekharu	anirban2012	PhD
	Sandipan sarma	sandipan.sarma	PhD
194101019	IRA BISHT	ibisht	MTech-2
194101009	ASHISH KUMAR	ashish1995	MTech-2
194101043	SANIL UPADHYAY	s.upadhyay	MTech-2

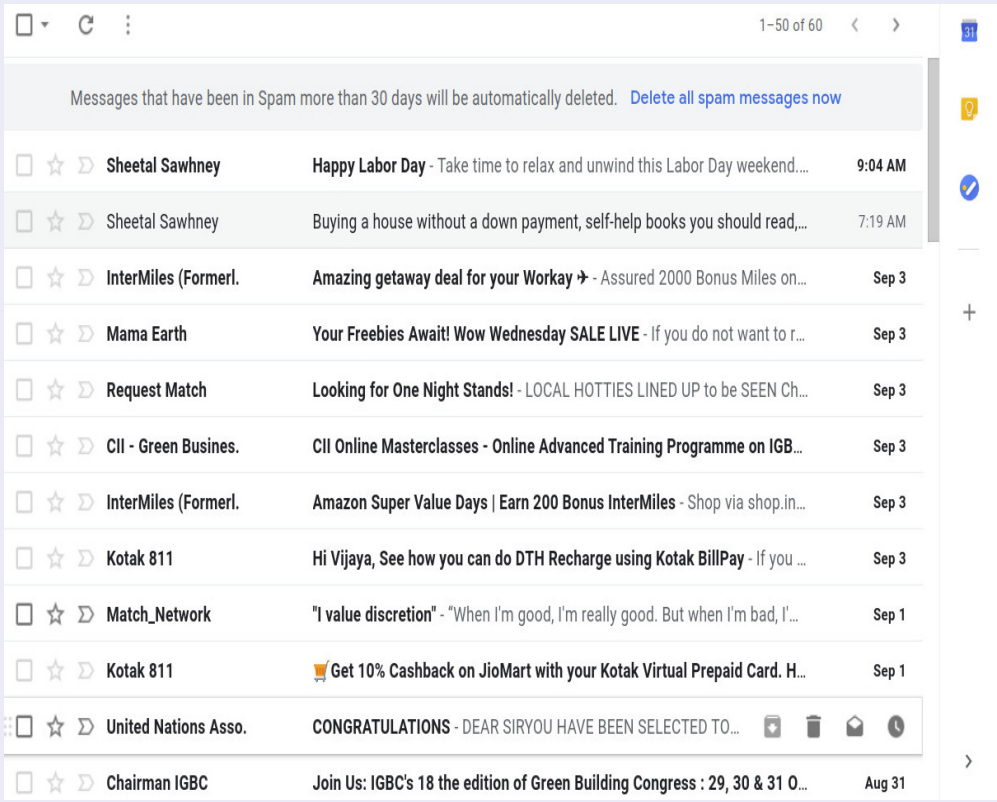
Applications

Examples

1. ML technology powers modern society
2. Web search
3. Content filtering on social networks
4. Recommendations on e-commerce websites
5. In consumer products such as cameras (recognizes faces and smiling faces)
6. Smart phones (image recognition/finger print recognition)
7. Identify objects (Object recognition)
8. Transcribe speech into text
9. Match news items, posts or products with users' interest
10. Health care vertical, financial vertical, insurance vertical, education vertical etc.

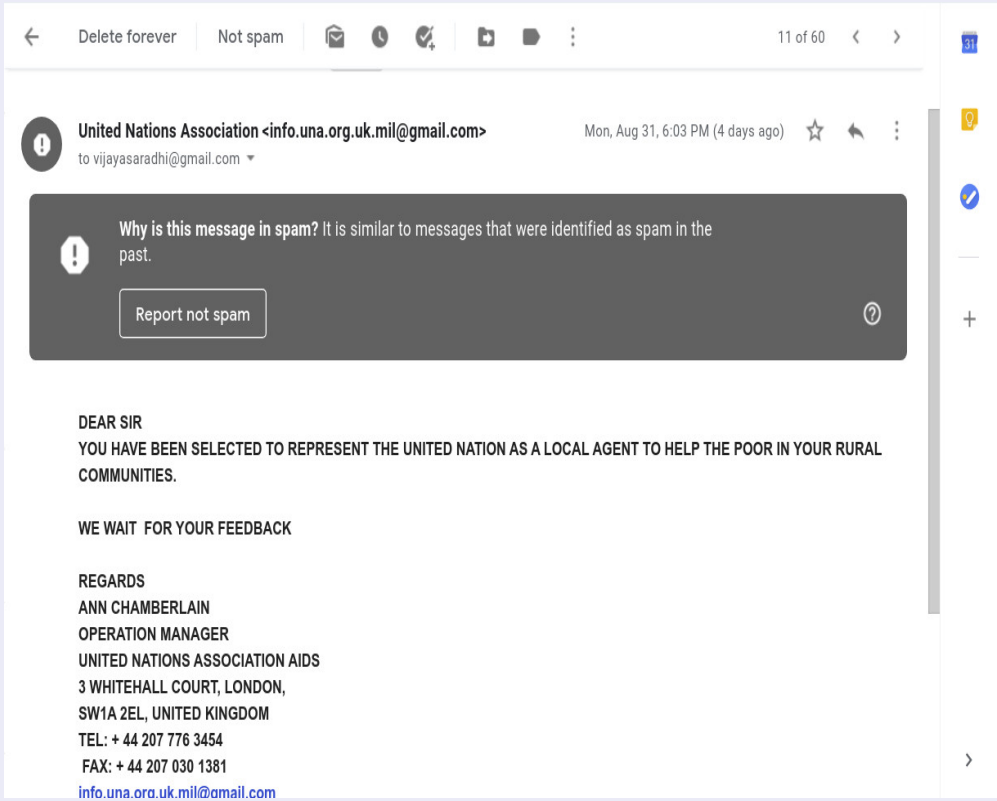
Applications

Spam Email Filtering



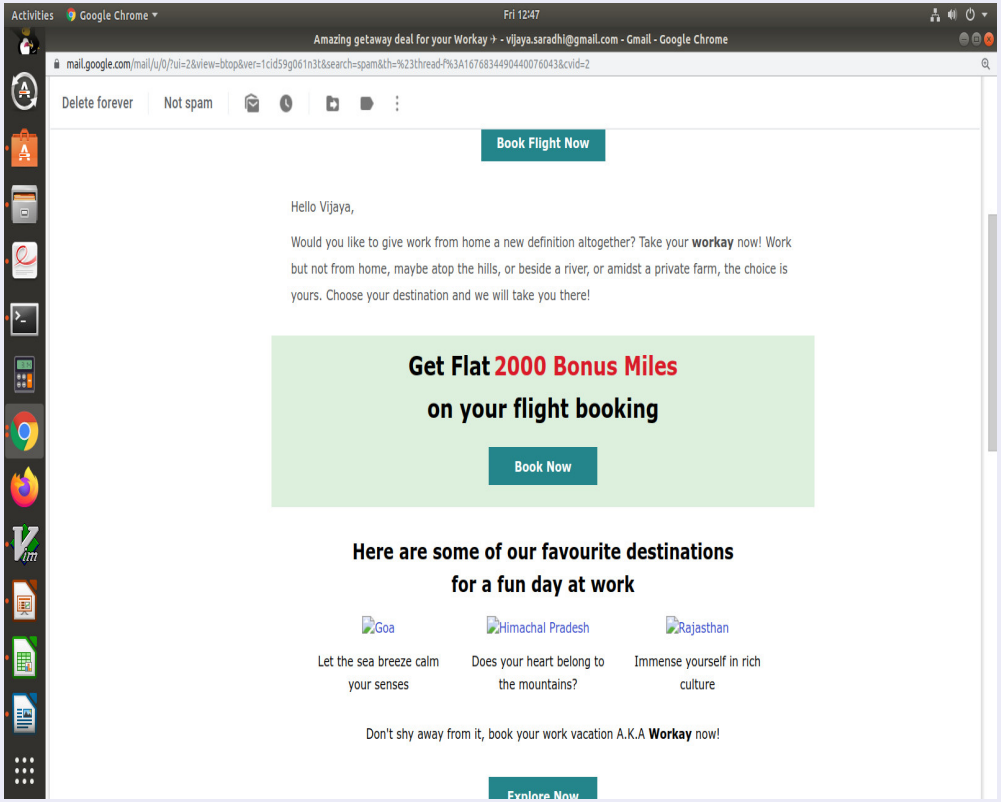
Example Spam Mail

Contents?



Example Spam Mail

Contents?



Data Types

Raw data

1. Numerical
2. Categorical
3. Text
4. Image
5. Audio
6. Video
7. Natural language
8. Time series
9. Gestures
10. Graphs
11. And many more

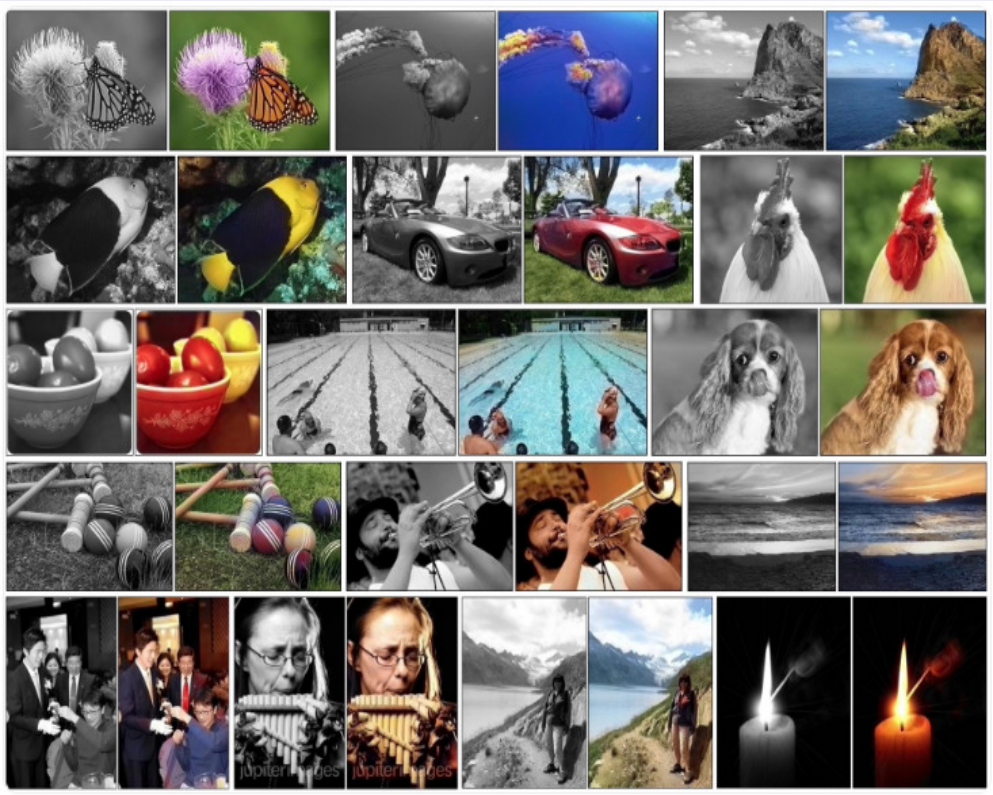
Conventional ML Limitations

Limitations

1. Ability to process natural data in their raw form
2. Constructing a ML system required careful engineering
3. Requires considerable domain expertise to represent the data (design feature extractors)
4. Obtain suitable internal representation for task at hand

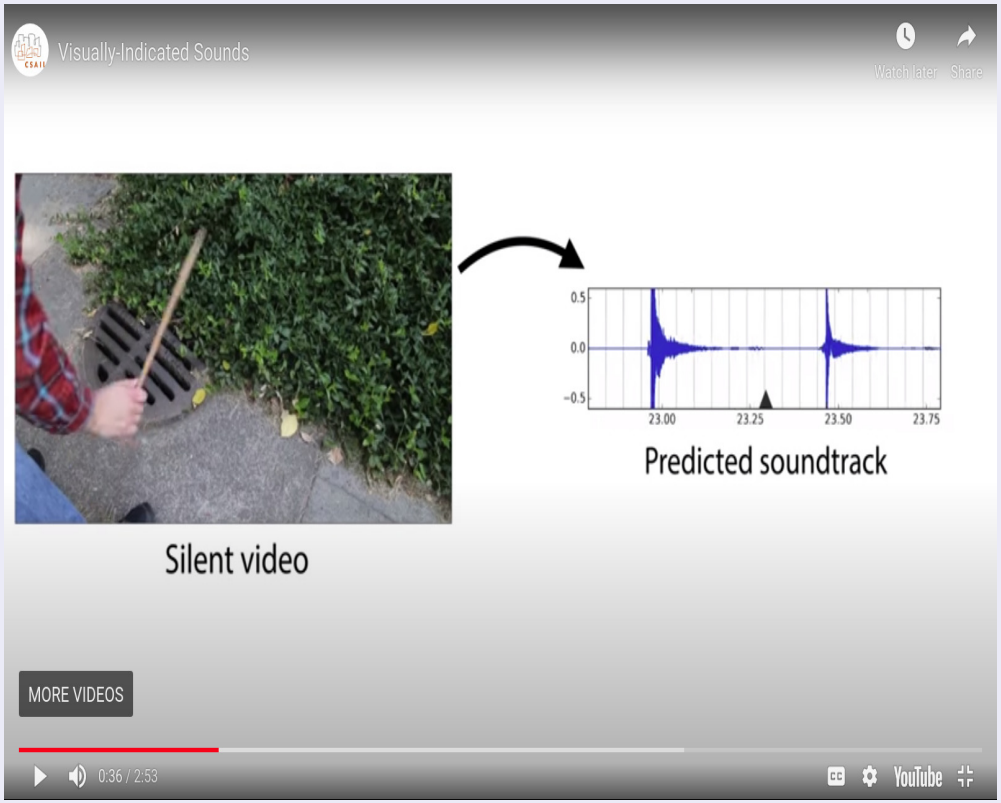
Deep Learning Applications - 01

Image Colorization



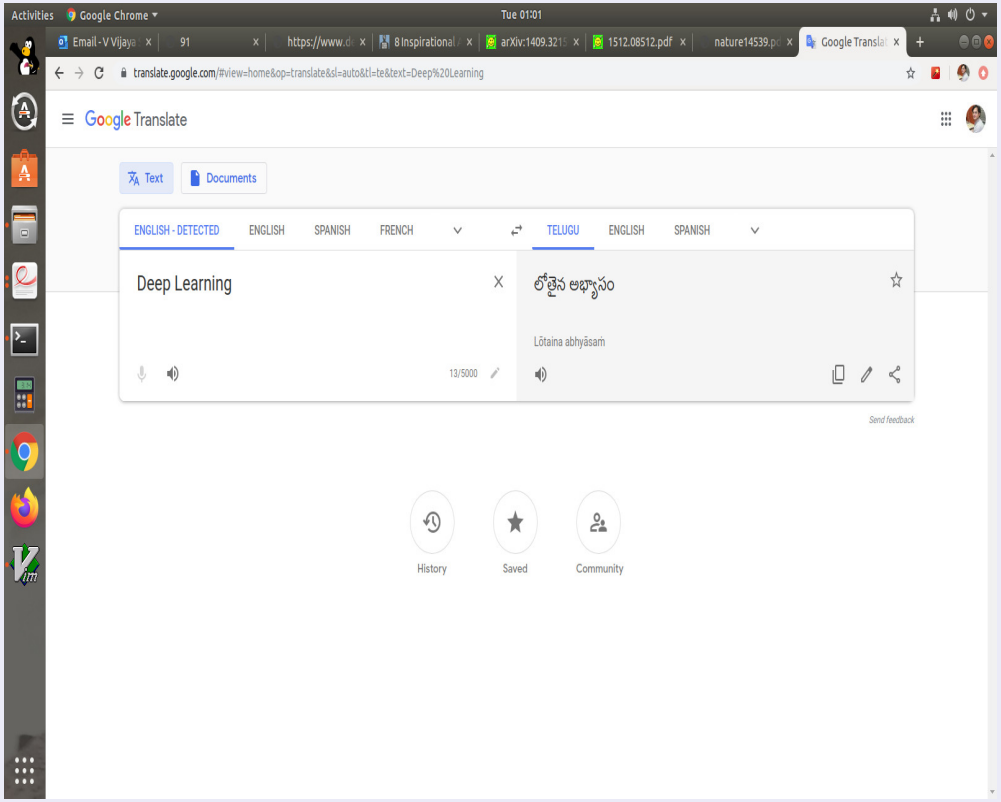
Deep Learning Applications - 02

Adding sounds to silent movies



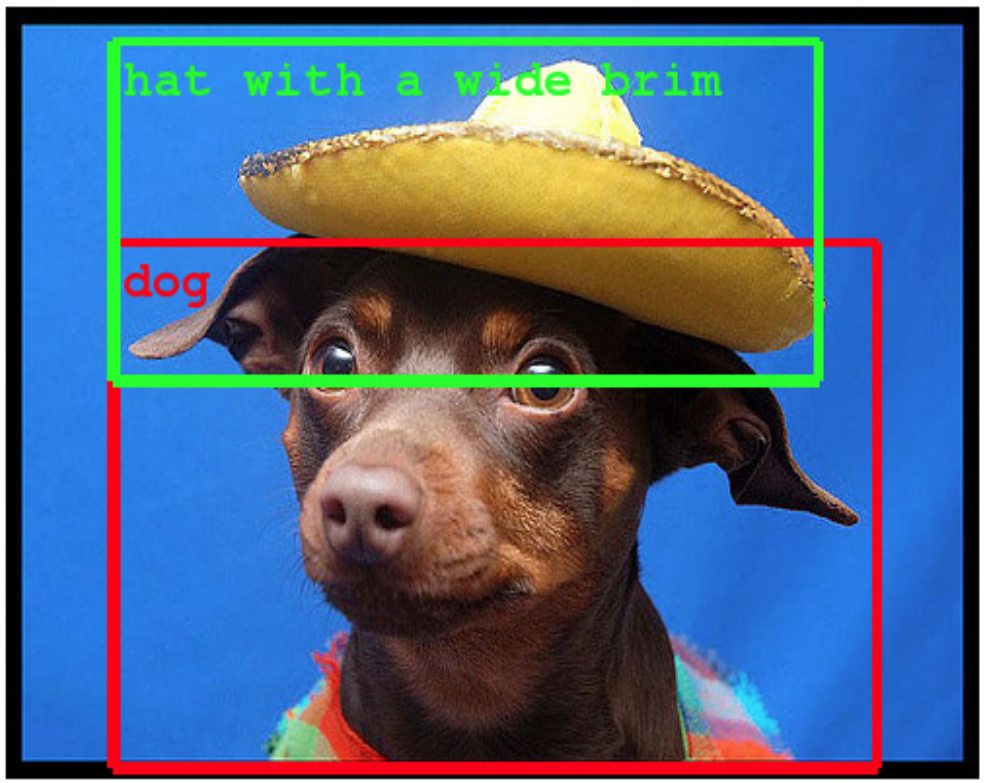
Deep Learning Applications - 03

Machine Translation



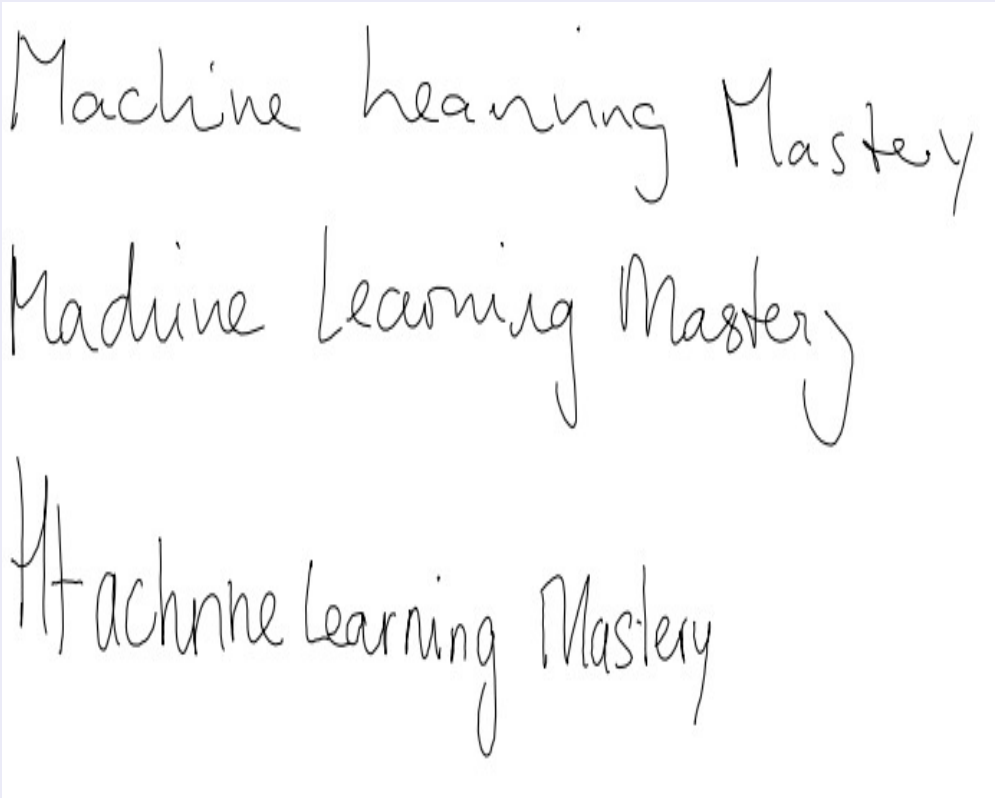
Deep Learning Applications - 04

Object classification and detection in photographs



Deep Learning Applications - 05

Hand written Generation



Deep Learning Applications - 06

Text Generation

```
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.

DUKE VINCENTIO:
Well, your wit is in the care of side and that.

Second Lord:
They would be ruled after this chamber, and
my fair nues begun out of the fact, to be conveyed,
Whose noble souls I'll have the heart of the wars.

Clown:
Come, sir, I will make did behold your worship.

VIOLA:
I'll drink it.
```

Deep Learning Applications - 07

Text Generation

```
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,
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Second Senator:
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Clown:
Come, sir, I will make did behold your worship.

VIOLA:
I'll drink it.
```

Deep Learning Applications - 08

Image caption Generation

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- One
- Two
- Three