Norwegian University of Science and Technology

Advanced Machine Learning With Python DT8807

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NTNU in Ålesund
12.01.2022

Learning outcomes

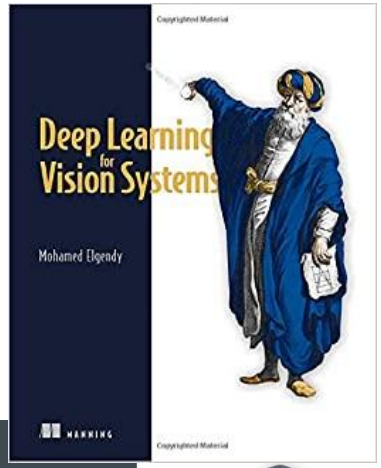
1. An understanding of the capabilities and limitations of machine learning (ML), and the knowledge of how to formulate your problem to solve it effectively.
2. An understanding of convolution neural nets, recurrent neural nets, and state-of-the-art transfer learning models.
3. An effective process for developing your machine learning pipeline to tackle real world problems such as machine vision, text understanding and time series prediction.
4. The skills required to deploying, monitoring, and evaluating the ML model, as well as assessing its relevance, and the uses of different ML models.
5. The basis required to collect, process, and utilize data efficiently.
6. The basic skills required to select the right platform to deploy your model (cloud, edge device, hybrid) and how to configure it to achieve the required performance.
7. The ability to document and communicate the results of your ML approach and guide your coding and ML efforts in the right direction.

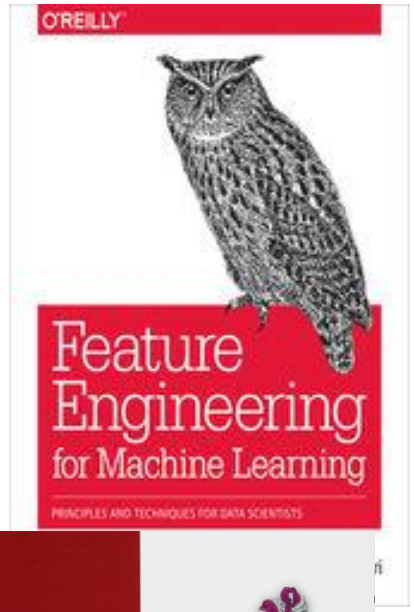
Course contents: … will be …

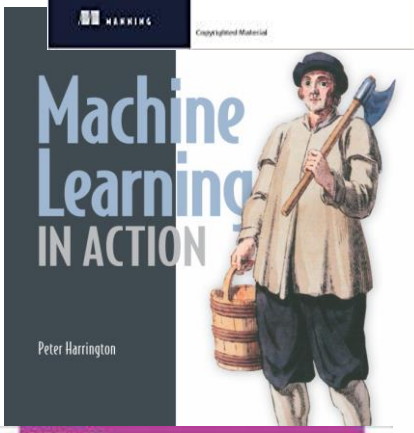
- Learning modes: supervised learning vs unsupervised learning
- Optimize to minimize error and maximize accuracy - a differentiable error/objective function.
- Representing data, engineering features, & dimensionality reduction to overcome risks such as overfitting.
- Model evaluation and improvement: machine learning pipeline – confusion matrix (accuracy - precision – recall) – type I error (false positive) and type II error (false negative)
- Perceptron, PLR, Artificial Neural Networks
- Training deep neural nets
- Convolutional neural networks
- Recurrent neural networks
- Advanced transfer learning models
- GPUs & cloud computing tools

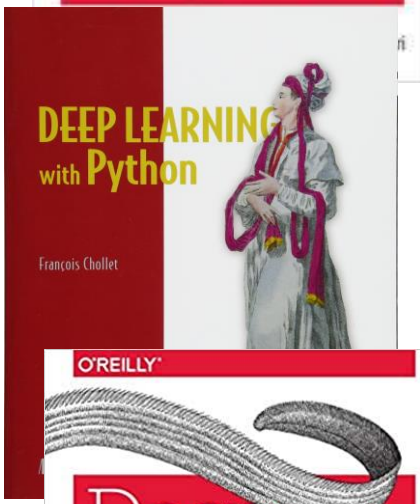
Reading list

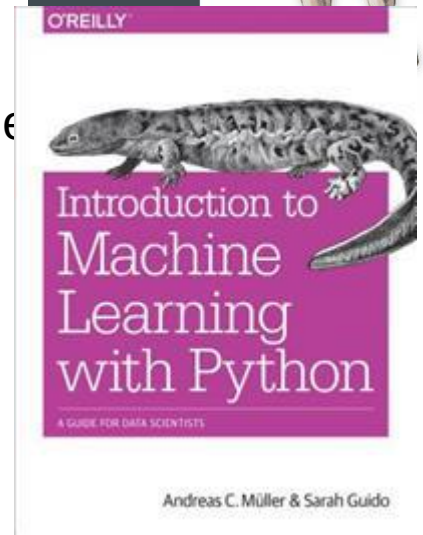
- Josh Patterson and Adam Gibson (2017). Deep learning: a practitioner's approach. O'Reilly.
- Andreas C. Muller and Sarah Guido (2017). Introduction to machine learning with python. O'Reilly.
- Mohamed Elgendy (2020). Deep learning for vision systems. O'Reilly.
- P. Harrington. Machine Learning in Action. 2012, Manning.
- Alice Zheng & Amanda Casari. Feature Engineering for Machine Learning: Principles and Techniques for Data Scientists. 2018, O'Reilly.
- François Chollet. Deep learning with python. 2018. Manning.

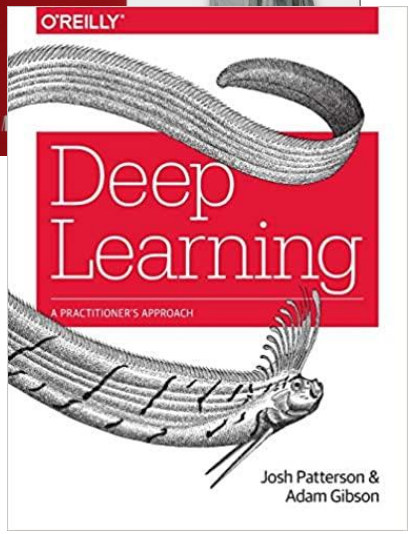












Course material

https://www.ntnu.no/studier/emner/DT8807#tab=omEmnet

GitHub page

https://github.com/ibribr/ML

Datasets from Kaggle

https://www.kaggle.com/

UCI ML repository

https://archive.ics.uci.edu/ml/index.php

DT8807 - Avanserte emner innen dyplæring med python

Om emnet | Timeplan | Eksamensinfo

Høst 2020/ Vår 2021

Nytt fra studieåret 2020/2021

Vurderingsordning

Vurderingsordning: Mappevurdering
Karakter: Bestått/Ikke bestått

Vurderingsform	Vekting	Varighet	Hjelpemidler
Mappevurdering	100/100		

Faglig innhold

In this course you will learn about the purpose of machine learning, where and how to apply it in the real world. You will learn fundamentals of machine learning such as supervised learning, unsupervised learning, feature engineering, model selection, training modes, and model evaluation. You will learn how to develop your machine learning pipeline in Python using sklearn, kears and pytorch. In this course, you will add new skills and new competence to your portfolio including regression, classification, clustering, and time series prediction. You will master skills of training deep neural nets such as CNN, RNN for images, videos, text, and time-series. You will learn about advanced deep learning architectures and transfer learning.

Læringsutbytte

Upon Completion of This Course, You'll Have:

1. An understanding of the capabilities and limitations of machine learning (ML), and the knowledge of how to formulate your problem to solve it effectively.
2. An understanding of convolution neural nets, recurrent neural nets, and state-of-the-art transfer learning models.
3. An effective process for developing your machine learning pipeline to tackle real world problems such as machine vision, text understanding and time series prediction.
4. The skills required to deploying, monitoring, and evaluating the ML model, as well as assessing its relevance, and the uses of different ML models.
5. The basis required to collect, process, and utilize data efficiently.
6. The basic skills required to select the right platform to deploy your model (cloud, edge device, hybrid) and how to configure it to achieve the required performance.
7. The ability to document and communicate the results of your ML approach and guide your coding and ML efforts in the right direction.

Læringsformer og aktiviteter

- Teaching approach: 5 hours each (lectures - practice - project work).

Mer om vurdering

- Evaluation: exam will be in the form of a portfolio assessment where samples of work and mini projects will be used to evaluate the intended learning outcomes (ILOs) achievement throughout the course.
- **Bestått/Ikke bestått** (Pass/Fail): it is required to achieve 70/100 points or 70% in order to pass.

Anbefalte forkunnskaper

- You are expected to know some basic linear algebra and basic programming skills in Python.
- You are expected to be motivated and like working in teams.

Kursmateriell

An updated reading list will be provided before the course. To name but a few:

- Josh Patterson and Adam Gibson (2017). Deep learning: a practitioner's approach. O'Reilly.
- Andreas C. Muller and Sarah Guido (2017). Introduction to machine learning with python. O'Reilly.
- Mohamed Elgendy (2020). Deep learning for vision systems. O'Reilly.

Flere sider om emnet

Ingen

Fakta om emnet

Versjon: 1
Studiepoeng: 7.5 SP
Studienivå: Doktorgrads nivå

Undervisning

Termin nr.: 1
Undervises: VÅR 2021

Undervisningsspråk: Engelsk

Sted: Ålesund

Fagområde(r)

Datateknikk og informasjonsvitenskap

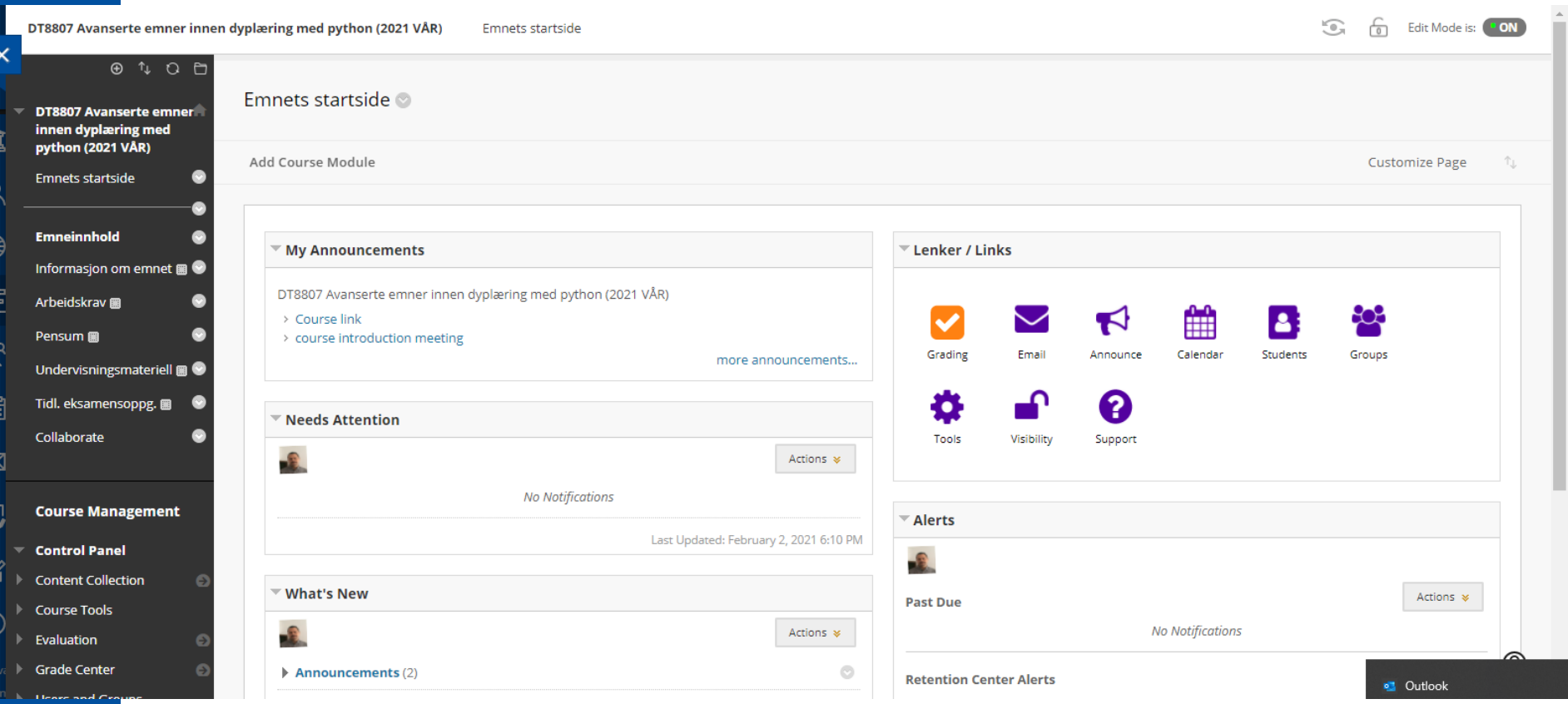
Kontaktinformasjon

Emneansvarlig/koordinator:
Ibrahim Abdelfatta Abdelhameed Ibrahim

Ansvarlig enhet
Institutt for IKT og realfag

Telefon:

Blackboard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Emneinnhold
Informasjon om emnet
Arbeidskrav
Pensum
Undervisningsmateriell
Tidl. eksamensoppg.
Collaborate
Course Management
Control Panel
Content Collection
Course Tools
Evaluation
Grade Center
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Add Course Module
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My Announcements
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Course link
course introduction meeting
more announcements...
Needs Attention
Actions
No Notifications
Last Updated: February 2, 2021 6:10 PM
What's New
Actions
Announcements (2)
Lenker / Links
Grading
Email
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Students
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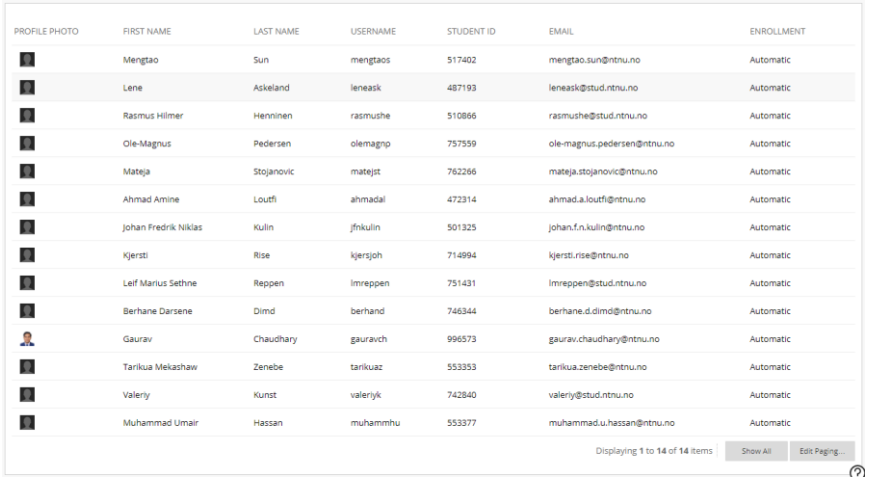
Visibility
Support
Alerts
Past Due
Actions
No Notifications
Retention Center Alerts
Outlook

Participants



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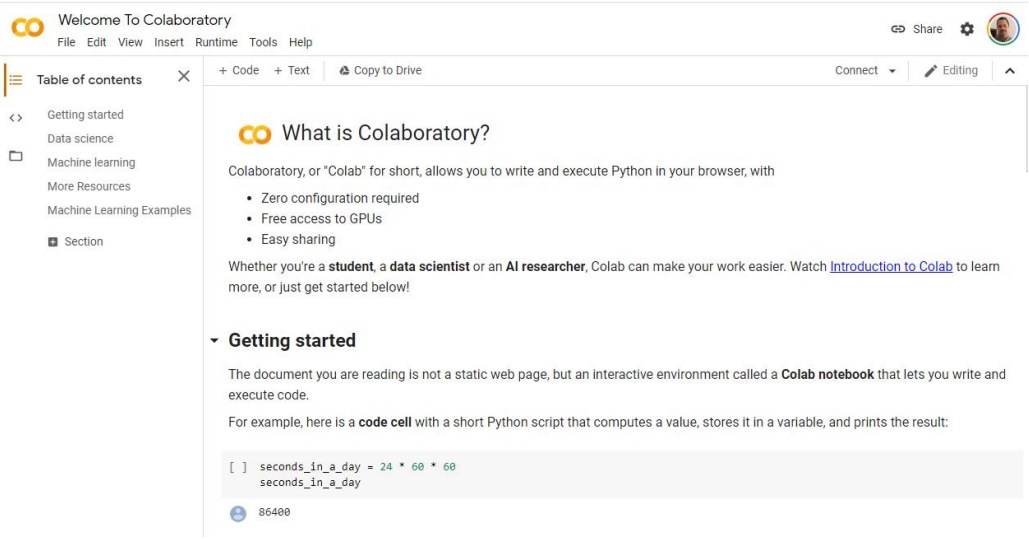
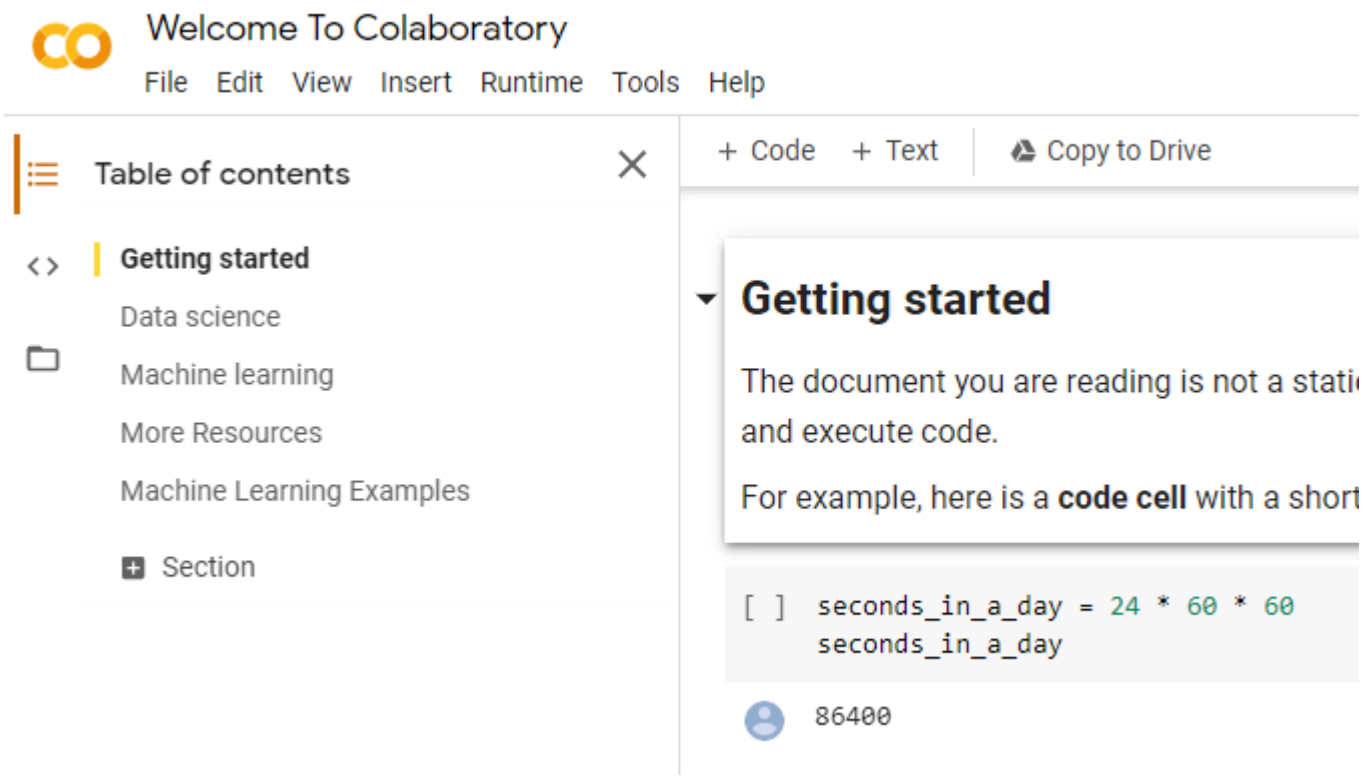
Google Colab

- Free and open-source environment for python development that requires no setup and runs entirely on the cloud.
- Colab is essentially the Google Suite version of a Jupyter Notebook.
- It contains all the pre-installed packages such as Keras, TensorFlow, and PyTorch required for AI and ML developers.
- You can develop deep learning applications on the GPU for free (TESLA K80 GPU) .



Introduction to Colab

- https://colab.research.google.com/notebooks/intro.ipynb#scrollTo=GJBs_flRovLc



Colab exercise

- Download iris dataset from UCI repository https://archive.ics.uci.edu/ml/datasets/iris

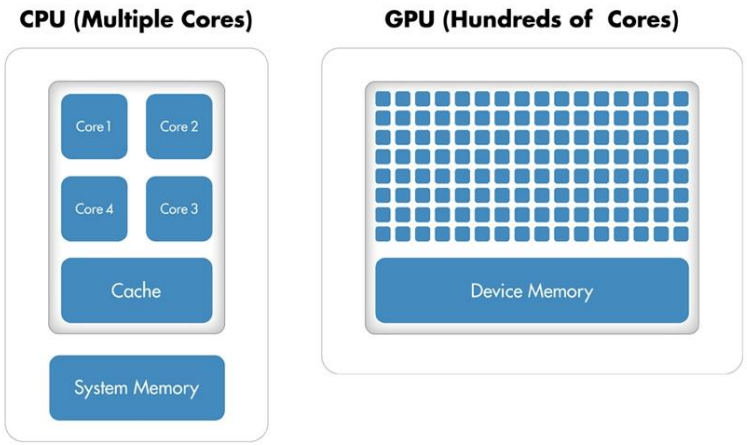
- Collected by Fisher in 1936.
- It has 4 attributes (sepal length and width in cm and petal length and width in cm) and 3 classes (Iris Setosa, Versicolour, and Virginica).

- Upload the data to Colab and plot it?

	A	B	C	D	E
1	Sepal Length	Sepal Width	Petal Length	Petal Width	Class
2	5.1	3.5	1.4	0.2	Iris-setosa
3	4.9	3	1.4	0.2	Iris-setosa
4	4.7	3.2	1.3	0.2	Iris-setosa
5	4.6	3.1	1.5	0.2	Iris-setosa
6	5	3.6	1.4	0.2	Iris-setosa
7	5.4	3.9	1.7	0.4	Iris-setosa
8	4.6	3.4	1.4	0.3	Iris-setosa
9	5	3.4	1.5	0.2	Iris-setosa
10	4.4	2.9	1.4	0.2	Iris-setosa
11	4.9	3.1	1.5	0.1	Iris-setosa
12	5.4	3.7	1.5	0.2	Iris-setosa
13	4.8	3.4	1.6	0.2	Iris-setosa
14	4.8	3	1.4	0.1	Iris-setosa
15	4.3	3	1.1	0.1	Iris-setosa
16	5.8	4	1.2	0.2	Iris-setosa
17	5.7	4.4	1.5	0.4	Iris-setosa
18	5.4	3.9	1.3	0.4	Iris-setosa
19	5.1	3.5	1.4	0.3	Iris-setosa
20	5.7	3.8	1.7	0.3	Iris-setosa
21	5.1	3.8	1.5	0.3	Iris-setosa
22	5.4	3.4	1.7	0.2	Iris-setosa
23	5.1	3.7	1.5	0.4	Iris-setosa
24	4.6	3.6	1	0.2	Iris-setosa
25	5.1	3.3	1.7	0.5	Iris-setosa

TIPS: Locally then on the cloud

- Build, train, and deploy machine learning (ML) models quickly requires massive computational resources.
- You will need a fast-enough GPU to do deep learning experiments locally for sample data to verify many things before going into full scale on the cloud.
- Vendors of top machine learning services in the cloud:
  - Amazon web services
  - Google cloud
  - IBM Watson
  - Microsoft Azure
  - Alibaba



Course assessment

- Portfolio assessment where sample of the work will be used to evaluate ILOs.
- Report which might lead to a publication
- Grading: pass (70%+)/fail

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Break …