

‘Introduction to analysis of time series data’

Dr Elena Hensinger
Dr Joanne Kitson

Toumetis Ltd.

WTH Workshop Wednesdays
25th Sept 2019



Tools

Do you have a Google account?

YES –> sit back and relax

NO –> please register for one now:

<https://accounts.google.com/signup/v2>

WHY? We will be working with the free online coding environment Colaboratory, which will save your notebooks (i.e. code) in your Google Drive.

Objectives of today's workshop

Introduction to time series data

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

- read in data

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

- read in data
- explore

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

- read in data
- explore
- clean, preprocess

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

- read in data
- explore
- clean, preprocess
- model in order to answer a problem statement

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

- read in data
- explore
- clean, preprocess
- model in order to answer a problem statement
- assess answer, evaluate model

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

- read in data
- explore
- clean, preprocess
- model in order to answer a problem statement
- assess answer, evaluate model

Create a project for your portfolio and prepare for a practical interview task

Objectives of today's workshop

Introduction to time series data

Experience typical stages and challenges of working with time series data

- read in data
- explore
- clean, preprocess
- model in order to answer a problem statement
- assess answer, evaluate model

Create a project for your portfolio and prepare for a practical interview task

Eat some pizza ~ 7.45pm

Time series data

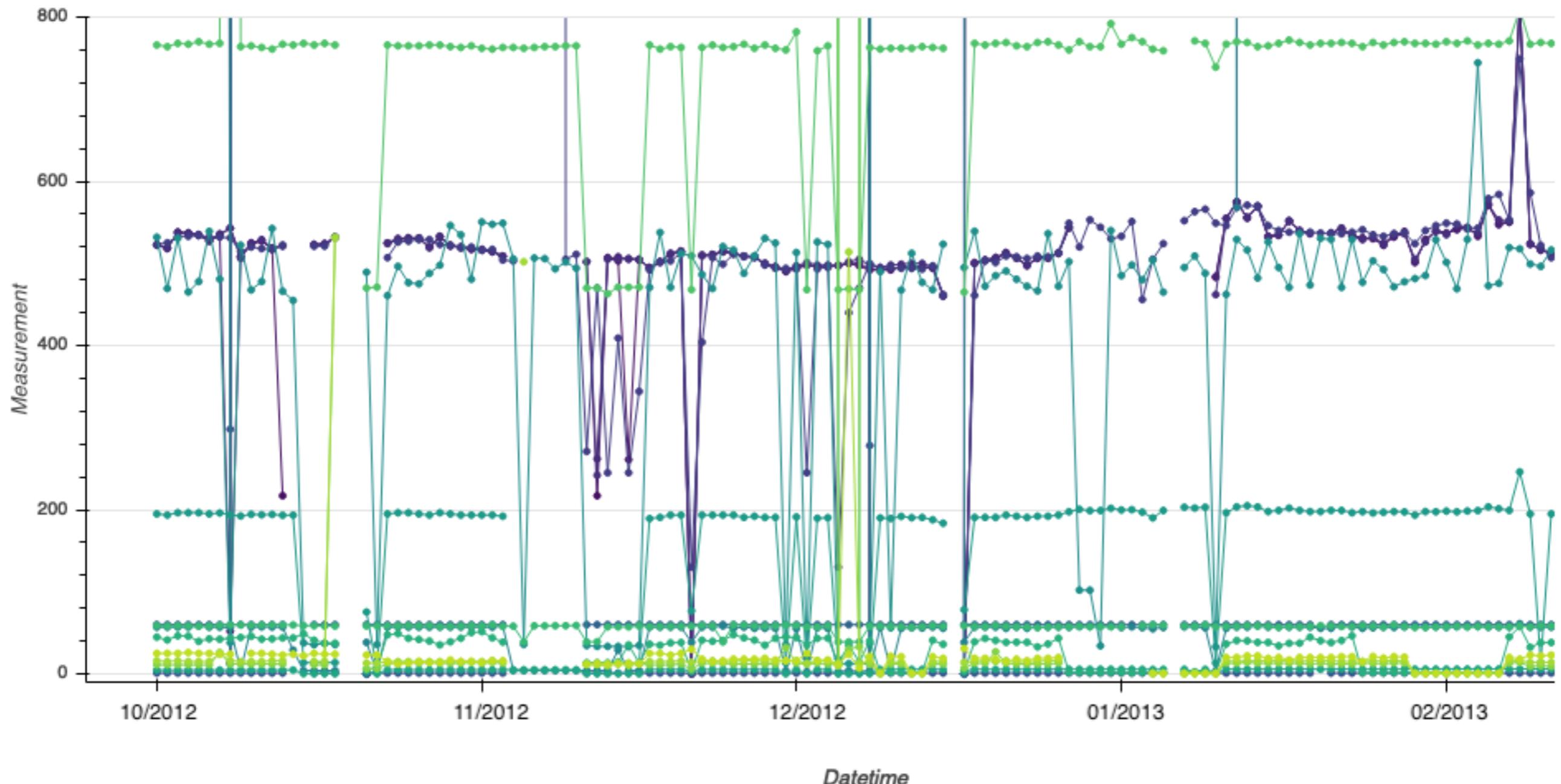
Data that is indexed or visualised in time order.

Ideally equal time steps

Examples:

- sales
- stock prices
- sensor measurements





What can we do with this data???

Practical interview task - example



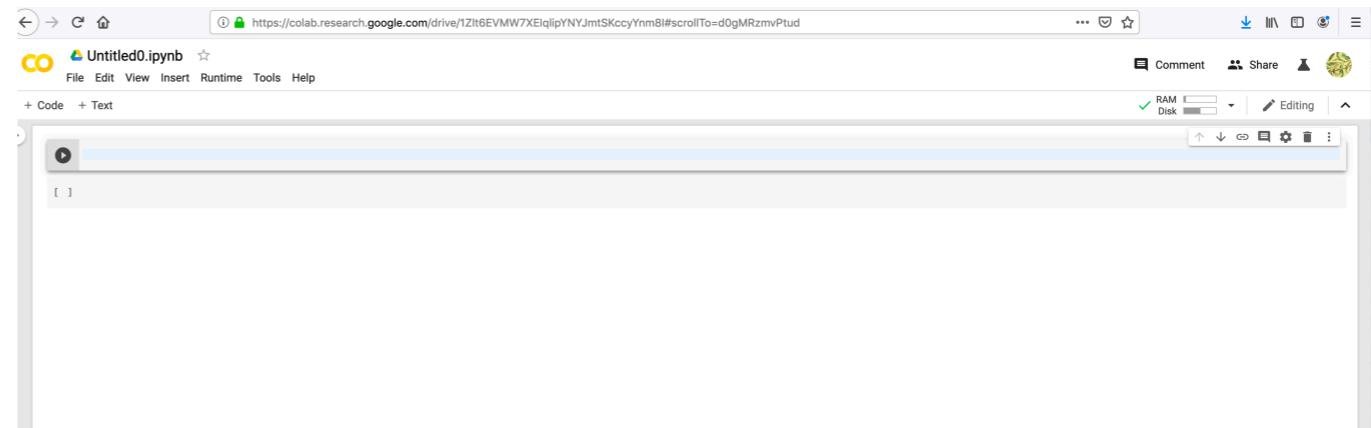
All set to go?

Tools

Google Colaboratory - interactive environment to run Python code

<https://colab.research.google.com/notebooks/welcome.ipynb>

- Follow URL to homepage
- Right-hand corner: Sign in
- You should get something like this



Tools, cont.

Colab is your own working space

- Change name for notebook into something like ‘Workshop_WTH_IntroData’
- Save
- Cells = code is executed here

What to analyse?

Browser: https://github.com/Toumetis/2019_09_25_WorkshopWednesdays

Download the data file in ‘datasets/’ into your Google Drive
(Button ‘Clone or Download’, choose ‘Download’ —> download zip file —> unzip)



All set to go?

A wide-angle photograph of a mountain range under a clear blue sky. The mountains are covered in white snow, with various peaks and ridges visible in the distance and closer to the viewer. The lighting suggests a bright day with some scattered clouds.

Let's work together

Hands-on demo

Download notebooks from repository

Go to Colab and log in with your Google account <https://colab.research.google.com/notebooks/welcome.ipynb>

‘File’ –> ‘Upload notebook’ –> choose the file
‘Electricity_Load_Classification_Workshop.ipynb’

Run cell by cell

Data Science

You did some Data Science!

Data Science

You did some Data Science!

Data science is the field of study that combines domain expertise, programming skills, and knowledge of math and statistics to **extract meaningful insights from data**.

(Source: <https://www.datarobot.com/wiki/data-science/>)

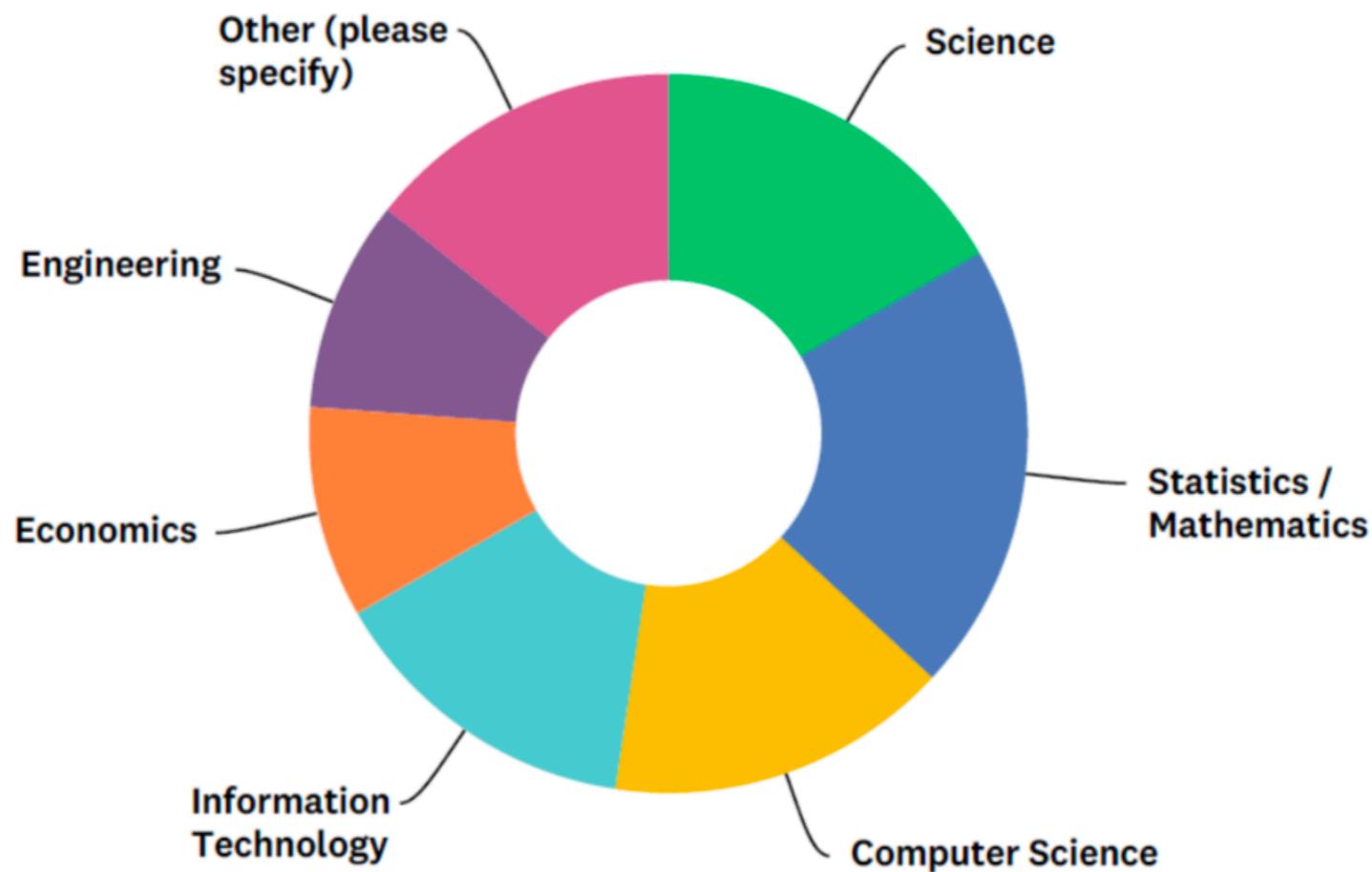
Data Science

You did some Data Science!

Data science is the field of study that combines domain expertise, programming skills, and knowledge of math and statistics to **extract meaningful insights from data**.

(Source: <https://www.datarobot.com/wiki/data-science/>)

A bit more about the people who do Data Science...

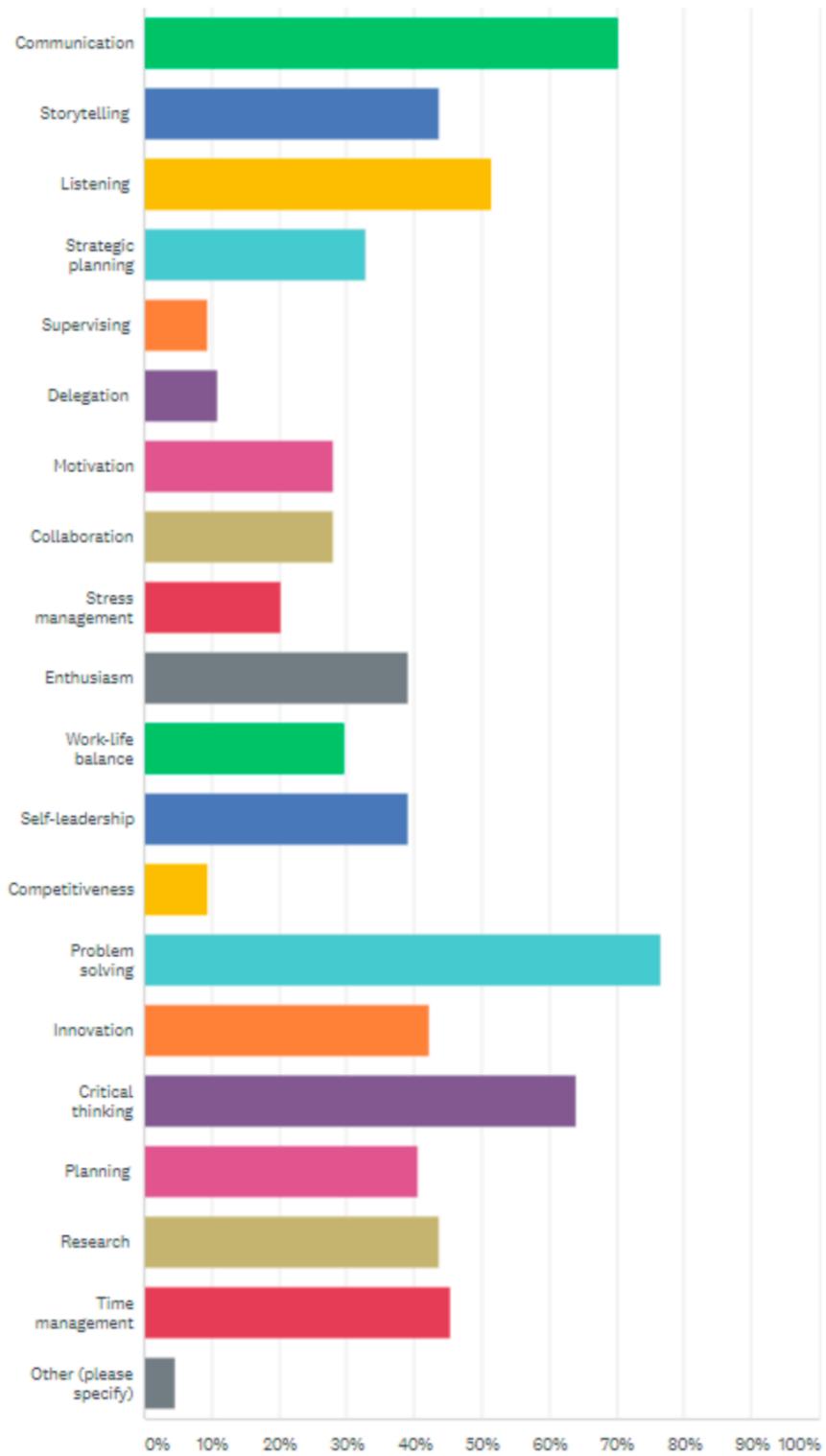


Background of data scientists

Source: 'The Timeline of Data Science - Reviewing the results' (Wade Macdonald recruiting)

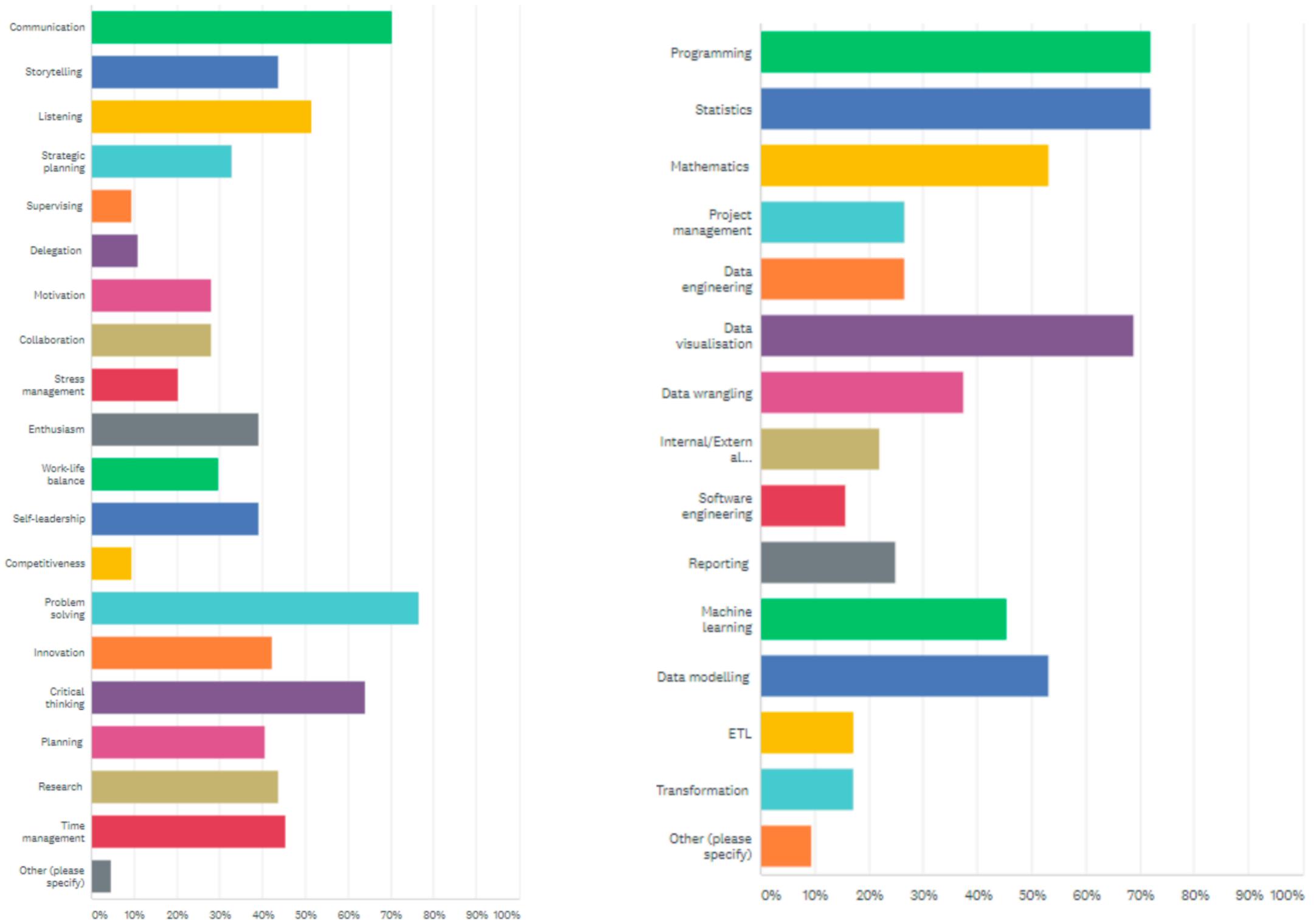
Skills required

Source: 'The Timeline of Data Science - Reviewing the results' (Wade Macdonald recruiting)



Skills required

Source: 'The Timeline of Data Science - Reviewing the results' (Wade Macdonald recruiting)



Skills required

Source: 'The Timeline of Data Science - Reviewing the results' (Wade Macdonald recruiting)

Links to articles, tutorials and datasets for time series

- Tutorial [https://machinelearningmastery.com/
decompose-time-series-data-trend-seasonality/](https://machinelearningmastery.com/decompose-time-series-data-trend-seasonality/)
- Datasets for all kinds of ML tasks, not only time series:
<https://archive.ics.uci.edu/ml/datasets.php>

Want to learn more?

- Women Who Code Data Science Slack channel: events; webinars and recordings (e.g. ‘DS Bootcamp’); resources; academic papers reading group; career topics; job opportunities <https://www.womenwhocode.com/datasience>
- Kaggle: datasets, tutorials, competitions <https://www.kaggle.com>
- UCI Machine Learning Repository - Datasets: <https://archive.ics.uci.edu/ml/datasets.php>
- Machine Learning Mastery - tutorials, guides <https://machinelearningmastery.com>
- Medium ‘Towards Data Science’: inspiration, visualisations <https://towardsdatascience.com>
- Learning Python: <https://pythonprogramming.net/> and the youtube channel by the same author <https://www.youtube.com/user/sentdex/featured>
- <https://www.fast.ai/> Various free courses, amongst other on Machine Learning, Deep Learning and Natural Language Processing
- explore local Meetup groups for Machine Learning and Data Science talks, workshops and learning groups

Women Who Code Data Science

Women Who Code inspires women to excel in technology careers.

656 Members | 10 Events

Launched March 2019

Join Us



Highlights Events About Get Involved Coding Resources

Join Us

Upcoming Events

THU
19
SEP

Mini Data Science Bootcamp Part III w/ Sumana *Featured*

6:00 PM – 7:15 PM (EDT) | ♦ ONLINE / REMOTE => See The #Track_events Channel In Slack

Register

SAT
28
SEP

Read and Implement Research Papers for Fun, learnings and profit! (Prof. + Researcher guided study group) – Part 2/2: Intro and Implementation of CNNs (convolutional neural nets) *Featured*

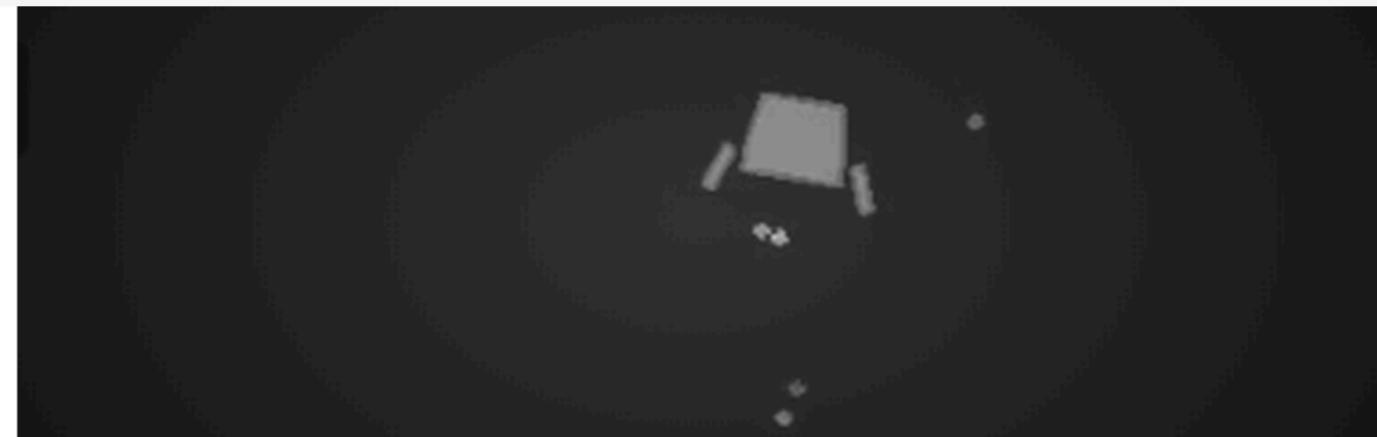
7:00 PM – 8:15 PM (EDT) | ♦ ONLINE / REMOTE => See The #Track_events Channel In Slack

Register

Upcoming tutorial and webinar events: **coming soon to a browser near you!**

- Computer Vision
- NLP
- Reinforcement Learning (beginner + advanced: learn to train a AI agent to play a Atari game: see screen shot =>)
- How to read research papers (for fun and profit)

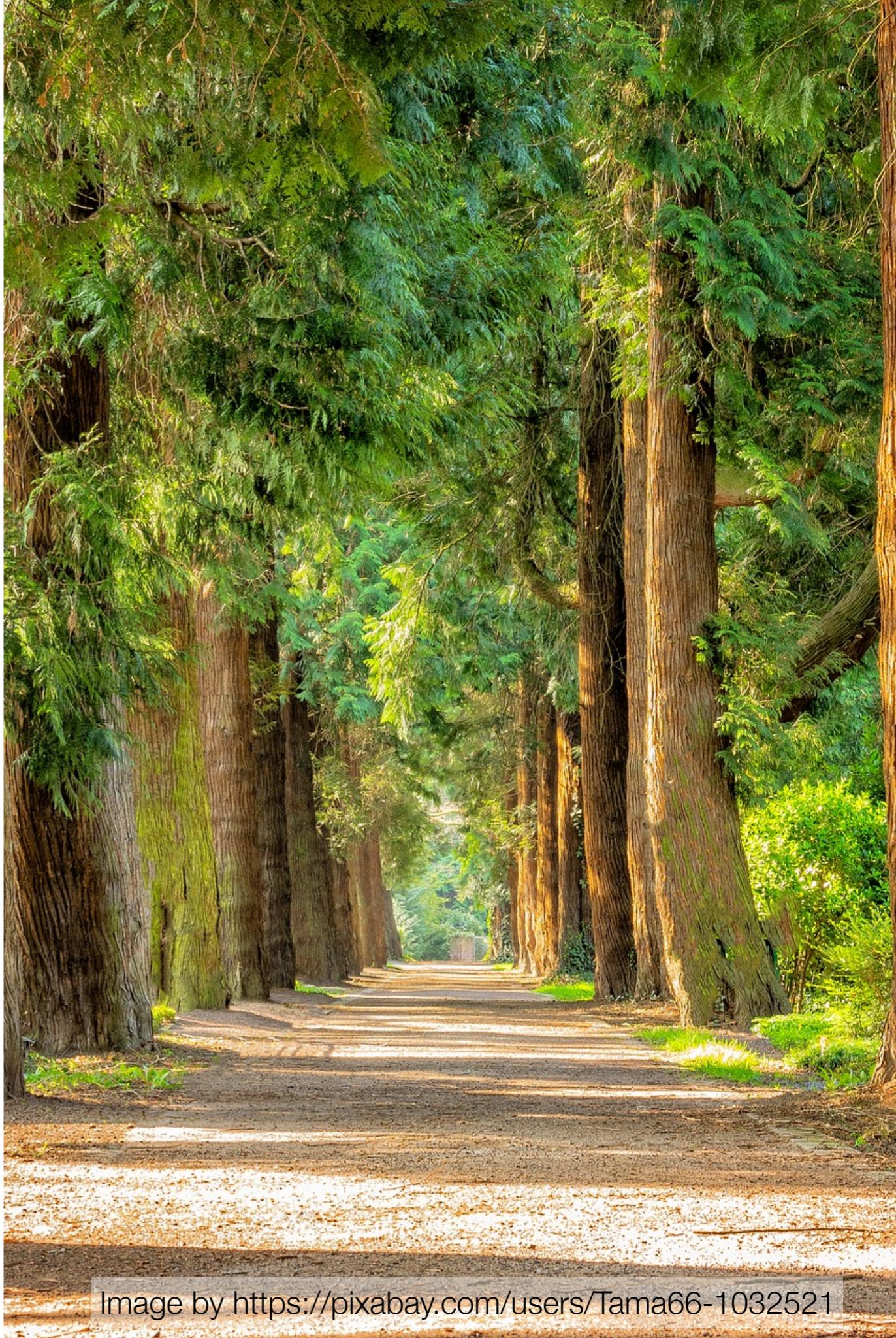
Sign up / join to be notified.



Stay in touch

Dr Elena Hensinger
elena@toumetis.com and on
LinkedIn

Toumetis Ltd. - hiring
<https://toumetis.bamboohr.com/jobs/>



Neural Networks

©2016 Fjodor van Veen - asimovinstitute.org

Backfed Input Cell

Input Cell

Noisy Input Cell

Hidden Cell

Probabilistic Hidden Cell

Spiking Hidden Cell

Output Cell

Match Input Output Cell

Recurrent Cell

Memory Cell

Different Memory Cell

Kernel

Convolution or Pool

Perceptron (P)

Feed Forward (FF)

Radial Basis Network (RBF)

Recurrent Neural Network (RNN)

Long / Short Term Memory (LSTM)

Gated Recurrent Unit (GRU)

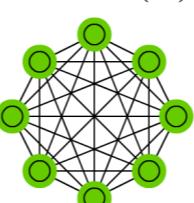
Auto Encoder (AE)

Variational AE (VAE)

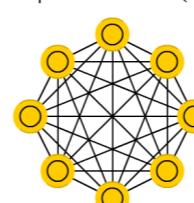
Denoising AE (DAE)

Sparse AE (SAE)

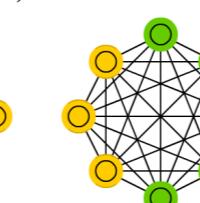
Markov Chain (MC)



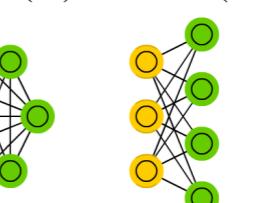
Hopfield Network (HN)



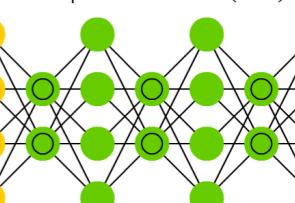
Boltzmann Machine (BM)



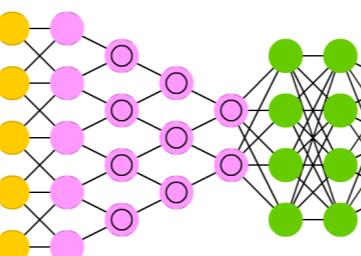
Restricted BM (RBM)



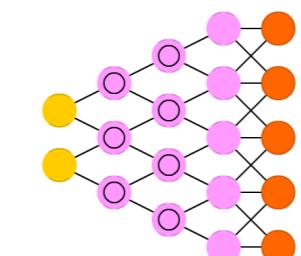
Deep Belief Network (DBN)



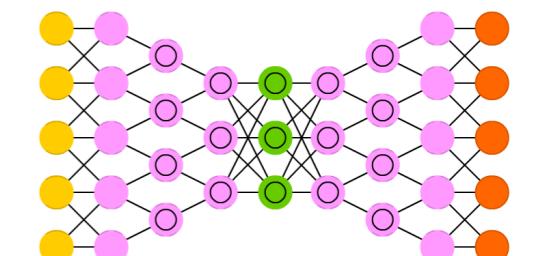
Deep Convolutional Network (DCN)



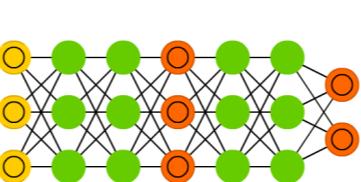
Deconvolutional Network (DN)



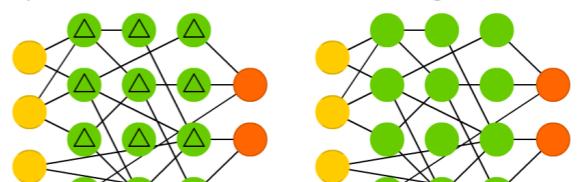
Deep Convolutional Inverse Graphics Network (DCIGN)



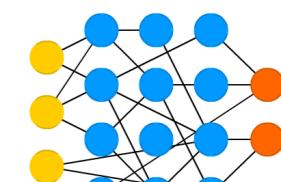
Generative Adversarial Network (GAN)



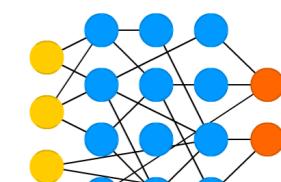
Liquid State Machine (LSM)



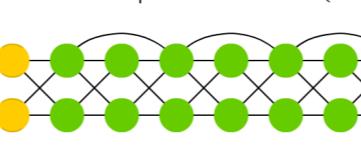
Extreme Learning Machine (ELM)



Echo State Network (ESN)



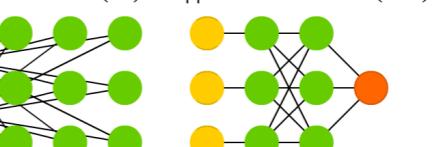
Deep Residual Network (DRN)



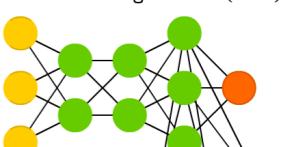
Kohonen Network (KN)



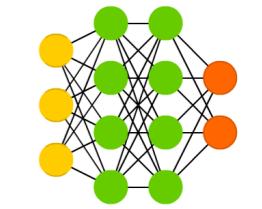
Support Vector Machine (SVM)



Neural Turing Machine (NTM)



Deep Feed Forward (DFF)



<https://towardsdatascience.com/the-mostly-complete-chart-of-neural-networks-explained-3fb6f2367464>