Additional readings & helpful references

Below you find a selection of additional material for you that may be helpful to keep alongside the course.

Please note that this material is optional and not intended as integral part of the course.

**Books**

Aurélien Géron - Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow, 2nd Edition, O'Reilly Media, Inc., 2019.

Francois Chollet - Deep Learning with Python, Manning Publications, 2017.

**Web Resources**

For a review of the field of deep learning:

<https://www.deeplearning.ai/deep-learning-specialization/>

# What is TensorFlow?

TensorFlow is now a daily tool for thousands of people worldwide interested in constructing neural networks: from researchers at universities to developers in big tech companies or startups, but also including you as a student in this course. TensorFlow is a software library used for machine learning applications, especially deep learning. It uses symbolic mathematics (instead of purely numerical computations), which enables it to perform operations like automatic differentiation on a computational graph such as a neural network. Another major benefit is its ability to perform computations on GPU hardware, potentially leading to large speedups. TensorFlow is one of the most popular libraries available for this purpose; other similar libraries include PyTorch, Chainer, Apache MXNet, Caffe and Microsoft CNTK.

TensorFlow was developed by [Google Brain](https://research.google/teams/brain/) and version 1.0.0 was released in 2017. It emerged from an earlier proprietary framework called DistBelief. You can listen to Andrew Ng discussing these early developments in an interview later in this course!

 TensorFlow is released as open source software, and has contributed to the democratisation of deep learning. It has an [active community](https://www.tensorflow.org/community) of contributors, [forums and user groups](https://www.tensorflow.org/community/forums), [blogs](https://blog.tensorflow.org/) and an active [YouTube channel](https://www.youtube.com/tensorflow/) including tutorials, presentations and interviews. This means that more and more people can share their code and tackle problems together in application areas as varied as medicine, NLP, finance or computer vision.

The latest release of TensorFlow 2 makes use of the Keras API as the default high-level abstraction to easily construct and customize neural networks, forgetting about the nitty-gritty algorithms written in C++ that are running behind the scenes. This greatly simplifies the numerical implementation for the user, resulting in a faster and intuitive algorithm implementation. You just need a few lines of code to define a cutting-edge convolutional network to identify objects in the street, or to build a recurrent layer to perform sentiment analysis on the tweets of your favourite politician.

Another fundamental feature of TensorFlow is its ability to develop and deploy models in multiple platforms and environments. The [TensorFlow ecosystem](https://www.tensorflow.org/learn) supports development in Python, JavaScript or Swift, with data preprocessing and model building and training pipelines. If you want to run your model in a web browser you can use [TensorFlow.js](https://www.tensorflow.org/js), or to deploy on mobile and embedded devices then you can choose [TensorFlow Lite](https://www.tensorflow.org/lite/). And if you are interested in large-scale production environments your choice is [TensorFlow Extended](https://www.tensorflow.org/tfx/). This means that TensorFlow is aiming to ensure the portability and scalability of the software, thus paving the way towards a future where any device could make use of neural networks while receiving information from IoT sensors and cloud servers. There are now indeed several chipsets whose aim is solely to execute neural networks, such as the [TPU from Google](https://cloud.google.com/tpu/?utm_source=google&utm_medium=cpc&utm_campaign=emea-gb-all-en-dr-bkws-all-all-trial-e-gcp-1008073&utm_content=text-ad-none-any-DEV_c-CRE_253485898497-ADGP_Hybrid+%7C+AW+SEM+%7C+BKWS+~+EXA_M:1_GB_EN_ML_Cloud+TPU_tpu-KWID_43700020953280584-kwd-376786503517-userloc_9045903&utm_term=KW_tpu%20googleg&ds_rl=1242853&ds_rl=1245734&ds_rl=1245734&gclid=Cj0KCQiAwP3yBRCkARIsAABGiPqdVXqZ7xYPmeUuXeXTTt_v3-F78zNPXggDqCdb-7SuZCfSchyQQIUaAsVLEALw_wcB) or the [FSD chip from Tesla](https://fuse.wikichip.org/news/2707/inside-teslas-neural-processor-in-the-fsd-chip/).

Undoubtedly the greatest value that TensorFlow brings to our lives is the possibility of unleashing the full potential of deep learning. By being open source more and more people can work on algorithms and applications, and as a result progress in the field of deep learning has soared in recent years. There is still a long path to unravel in the quest towards [Artificial General Intelligence (AGI)](https://www.forbes.com/sites/cognitiveworld/2019/06/10/how-far-are-we-from-achieving-artificial-general-intelligence/#3e9e93b76dc4), but thanks to people like you we are closer to achieving it every day. Are you now ready to build neural networks with TensorFlow?

# Google Colab resources

Further resources for Google Colab can be found at the [Welcome to Colaboratory](https://colab.research.google.com/notebooks/welcome.ipynb) page. We recommend that you take some time to look through this page and the links therein.

# TensorFlow documentation

The TensorFlow documentation can be found at [this link](https://www.tensorflow.org/api_docs/python/tf). We recommend you take some time to browse the documentation to familiarise yourself with it. This will be a useful resource as you continue to learn and develop with TensorFlow during and beyond this course.