

# Deep Learning

UFRN 2018.1

Prof. Helton Maia

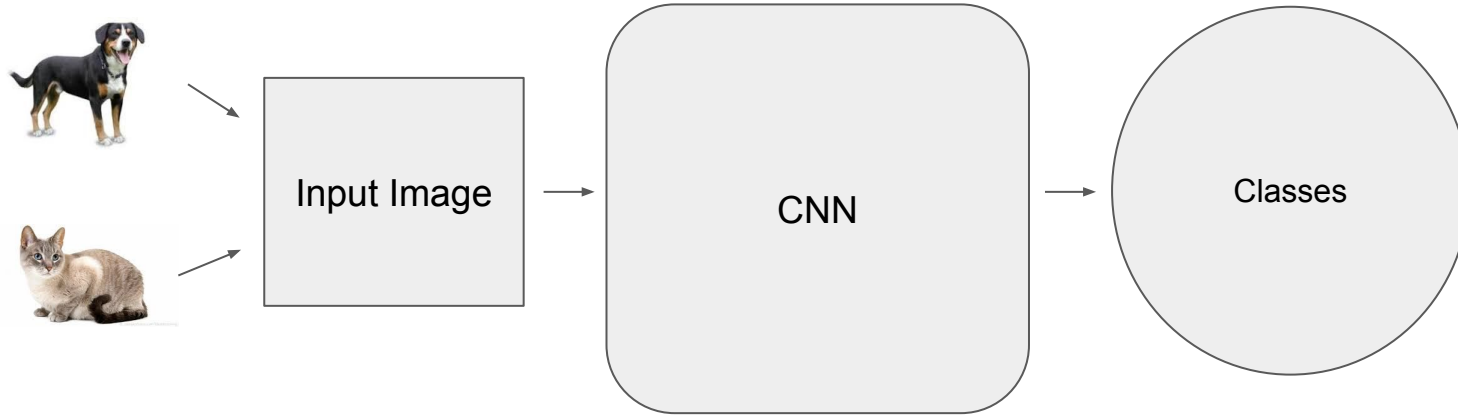
# Plano de Estudos

- Semana 1: *What is Deep Learning ?*
- Semana 2: Fundamentos de Machine Learning
  - Introdução
  - Aprendizagem Supervisionada
  - CNN - *Layers : Convolutional, Activation, Pooling, Flattening, Fully-connected*
- **Semana 3: Processamento de Imagens em Python**
  - Instalação de pacotes e preparação do ambiente
  - Manipulando imagens com OpenCV
- **Semanas 4-5: Construindo o Primeiro Classificador**
  - Conhecendo o Keras
  - Repetindo exemplos conhecidos
  - Projeto: Desenho e implementação de um novo experimento
- **Semanas 6-7: Otimizando o Classificador**
  - Analisando resultados e testando parâmetros
  - Apresentação de resultados

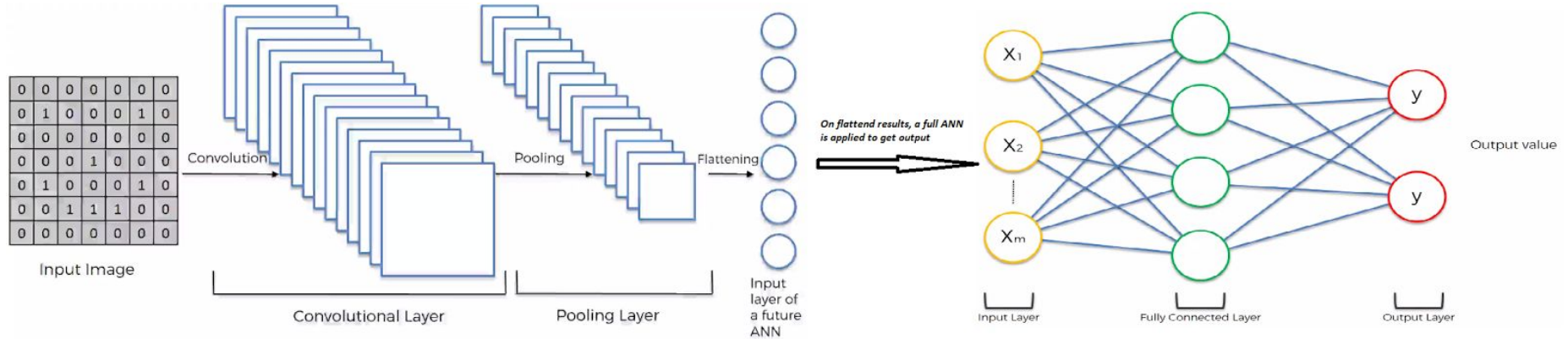
# Semana 3

# What is Deep Learning?

“A machine learning technique that learns **features** and **tasks** directly from data”.




# Full Connection



## Instalação de pacotes e preparação do ambiente:

- Linux/VM
- Python 3.6
- Anaconda 1.6.5
- Conda
- Spyder 3.2.7
- OpenCV 3.3.0
- Keras 2.1.4
- Tensorflow 1.4.1
- GitHub



#<https://keras.io/>

```
from keras.models import Sequential  
model = Sequential()
```

# Example Dataset

Browser address bar: <https://www.superdatascience.com/deep-learning/>

Most Visited | Getting Started | <http://localhost:3000/>

**SUPER DATASCIENCE**

*Descent*

- Michael Nielsen, 2015, [Neural Networks and Deep Learning](#)

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## PART 2. CONVOLUTIONAL NEURAL NETWORKS (CNN)

Datasets & Templates:

- [Convolutional\\_Neural\\_Networks](#)

Additional Reading:

- Yann LeCun et al., 1998, [Gradient-Based Learning Applied to Document Recognition](#)
- Jianxin Wu, 2017, [Introduction to Convolutional Neural Networks](#)
- C.-C. Jay Kuo, 2016, [Understanding Convolutional Neural Networks with A Mathematical Model](#)
- Kaiming He et al., 2015, [Delving Deep into Rectifiers: Surpassing Human-Level Performance on ImageNet Classification](#)
- Dominik Scherer et al., 2010, [Evaluation of Pooling Operations in Convolutional Architectures for Object Recognition](#)
- Adit Deshpande, 2016, [The 9 Deep Learning Papers You Need To Know About \(Understanding CNNs Part 3\)](#)
- Rob DiPietro, 2016, [A Friendly Introduction to Cross-Entropy Loss](#)
- Peter Roelants, 2016, [How to implement a neural network Intermezzo 2](#)

| Name                | Size    | Type   | Date Modified   |
|---------------------|---------|--------|-----------------|
| ▶ single_prediction | 2 items | Folder | sáb 25 fev 2017 |
| ▶ test_set          | 2 items | Folder | qua 07 dez 2016 |
| ▶ training_set      | 2 items | Folder | qua 07 dez 2016 |











<https://www.superdatascience.com/deep-learning/>

# Datasets

https://www.kaggle.com/datasets?sortBy=relevance&group=public&search=image+&page=1&pageSize=... Search

Public Your Datasets Favorites Sort by Relevance

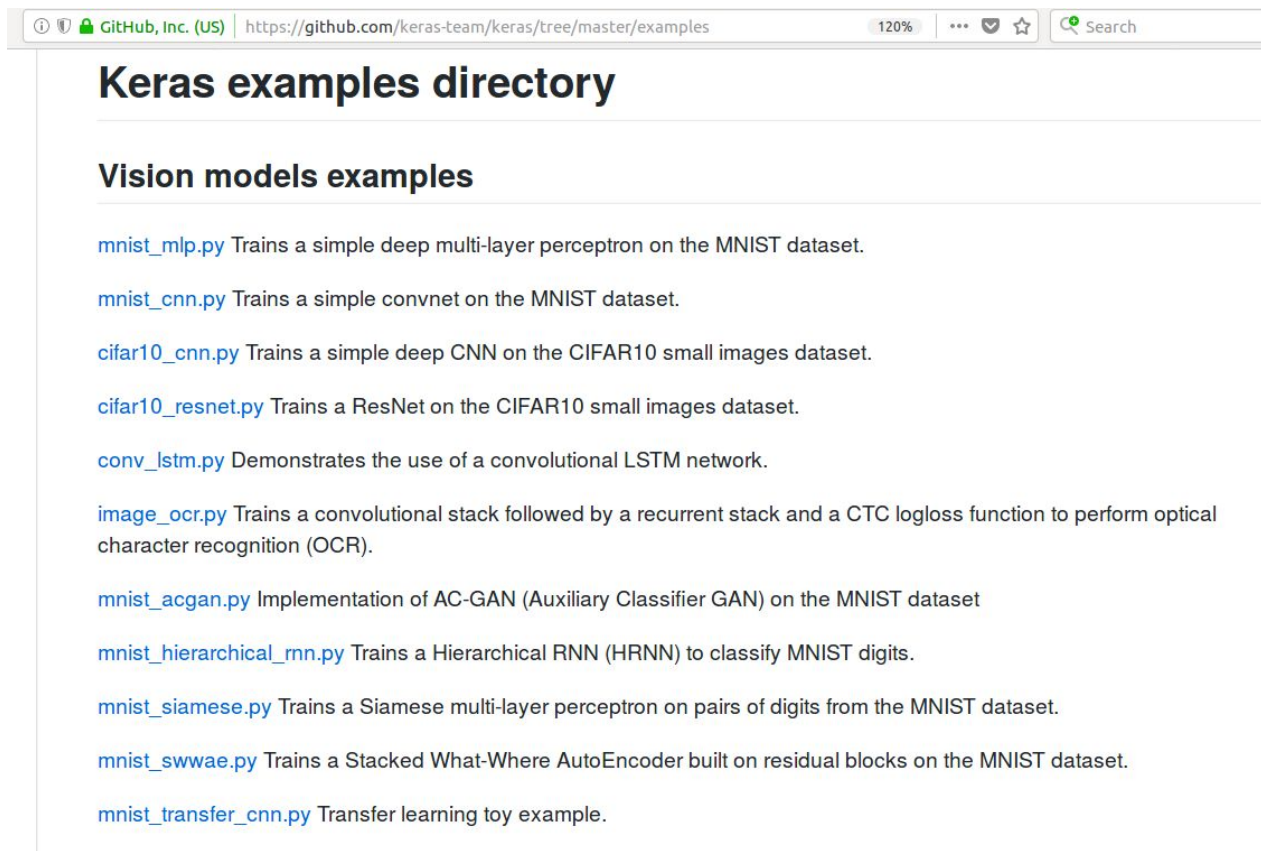
387 Datasets Sizes File types Licenses Tags image |

|    |  |   |   |                          |                  |
|----|--|---|---|--------------------------|------------------|
| 33 |   | <b>Food Images (Food-101)</b><br>Labeled food images in 101 categories from apple pies to waffles<br>Kevin Mader updated 7 months ago                         | food and drink<br>popular culture<br>image data<br>multiclass classification  | Other<br>663 MB<br>Other | < 10<br>0<br>10k |
| 14 |   | <b>Open Sprayer images</b><br>A collection of broad leaved dock images for weed sprayer<br>GavinArmstrong updated 4 months ago                                | agriculture<br>agronomy<br>surveillance<br>image data                         | Other<br>148 MB<br>CC0   | < 0<br>1<br>1k   |
| 21 |   | <b>Multispectral Image Classification</b><br>Handwritten numbers (0-9) from six different people and two different pens<br>Little Boat updated a year ago     | writing<br>artificial intelligence<br>image data<br>multiclass classification | Other<br>5 GB<br>Other   | < 10<br>1<br>5k  |
| 18 |   | <b>1k Pharmaceutical Pill Image Dataset</b><br>Speckled pills CNN feature extracted for unique individual identification<br>TruMedicines updated 8 months ago | healthcare<br>pharmacy<br>image data<br>multiclass classification             | Other<br>8 MB<br>ODbL    | < 0<br>1<br>3k   |
| 27 |   | <b>Breast Histopathology Images</b><br>IDC vs non-IDC classification<br>paultimothymooney updated 3 months ago  | medicine<br>machine learning<br>image data<br>binary classification           | Other<br>2 GB<br>CC0     | < 1<br>1<br>4k   |
| 72 |   | <b>CT Medical Image Analysis Tutorial</b><br>CT images from cancer imaging archive with contrast and patient age<br>Kevin Mader updated 10 months ago         | healthcare<br>tutorial<br>image data  | Other<br>437 MB<br>Other | < 24<br>4<br>21k |
| 12 |   | <b>Style Color Images</b><br>Brand and Product Recognition<br>Olga Belitskaya updated 3 months ago  | photography<br>clothing<br>deep learning<br>+ 2 more...                       | Other<br>49 MB<br>Other  | < 4<br>1<br>2k   |
| 42 |  | <b>Blood Cell Images</b><br>12,500 images: 4 different cell types<br>paultimothymooney updated 2 months ago   | medicine  | Other<br>293 MB<br>CC0   | < 1<br>1<br>3k   |

<https://www.kaggle.com/>



Datasets: <https://github.com/keras-team/keras/tree/master/examples>



The screenshot shows a web browser window displaying the GitHub repository for Keras examples. The address bar shows the URL <https://github.com/keras-team/keras/tree/master/examples>. The page title is "Keras examples directory". Below this, there is a section titled "Vision models examples". This section lists several Python scripts with brief descriptions of what they do:

- [mnist\\_mlp.py](#) Trains a simple deep multi-layer perceptron on the MNIST dataset.
- [mnist\\_cnn.py](#) Trains a simple convnet on the MNIST dataset.
- [cifar10\\_cnn.py](#) Trains a simple deep CNN on the CIFAR10 small images dataset.
- [cifar10\\_resnet.py](#) Trains a ResNet on the CIFAR10 small images dataset.
- [conv\\_lstm.py](#) Demonstrates the use of a convolutional LSTM network.
- [image\\_ocr.py](#) Trains a convolutional stack followed by a recurrent stack and a CTC logloss function to perform optical character recognition (OCR).
- [mnist\\_acgan.py](#) Implementation of AC-GAN (Auxiliary Classifier GAN) on the MNIST dataset
- [mnist\\_hierarchical\\_rnn.py](#) Trains a Hierarchical RNN (HRNN) to classify MNIST digits.
- [mnist\\_siamese.py](#) Trains a Siamese multi-layer perceptron on pairs of digits from the MNIST dataset.
- [mnist\\_sswae.py](#) Trains a Stacked What-Where AutoEncoder built on residual blocks on the MNIST dataset.
- [mnist\\_transfer\\_cnn.py](#) Transfer learning toy example.

# Colab Google - <https://colab.research.google.com>

Test: *convolve 32x7x7x3 filter over random 100x100x100x3 images (batch x height x width x channel).  
Sum of ten runs.*

Helton-CPU (s): 6.736331526000868

Google-CPU (s): 8.688575368999864

**Google-GPU (s): 0.17155587199977163**

**GPU speedup over CPU: 50x**

# Treinamento, validação e Testes



**Visualize your data:** histograms, scatter plots, debugging, find outliers/missing/duplicate values, rank metrics, etc.

## Próximas semanas:

- Semanas 4-5: Construindo o Primeiro Classificador
  - Conhecendo o Keras : *API Documentation*
  - Repetindo exemplos conhecidos:
    - 1) Testar e melhorar o desempenho do classificador exemplo (cat vs dog)
    - 2) Substituir as imagens/classes do item 1 e testar seu novo classificador
    - 3) Construa um classificador *multiclass* para um dataset conhecido a sua escolha
  - Projeto: Desenho e implementação de um novo experimento:
    - Discutir de ideias para o projeto