



>>> Introduction to Deep Learning
>>> The force Awakens

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KAREN HALLON 2015

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```
>>> $ whoami
```

1. PhD Candidate in Comp. Sci., working at Patagonian Research Center (CENPAT-CONICET) at the Research Group of Human Biology Evolution (GIBEH).
2. Member of the Image Sciences Lab (LCI - Bahia Blanca).
3. Professor at Engineering Department, Patagonian University UNPSJB.
4. Pythonista since 2008.
5. Happy member of LinuxChixAr.
6. Co-organizer of SciPy Latinoamericana¹ (2013, 2014) and Patagonia Python Meetup.



¹<http://conf.scipy.org/>

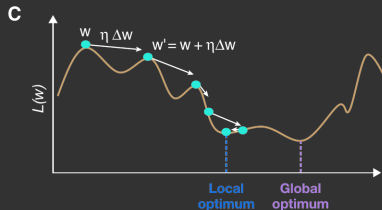
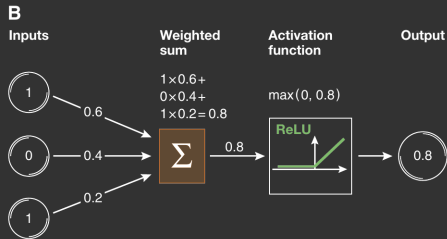
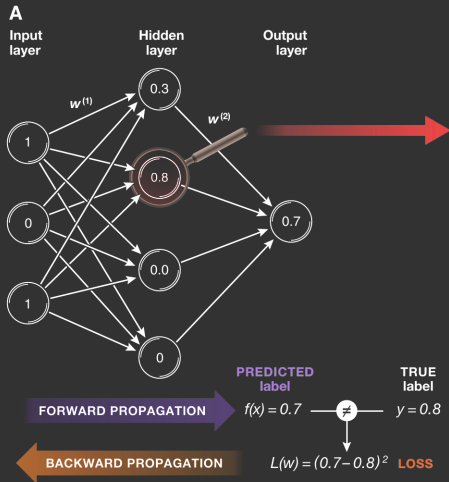


>>> Supervised Learning

It consists of inferring a function from labeled values. These values have the form of (X_i, y_i) , where X_i is the input value and y_i is the corresponding output value. In the training stage, the values generated by the inferred function are compared with the actual values y_i to reduce the error and improve the generated function.



>>> Neural Nets

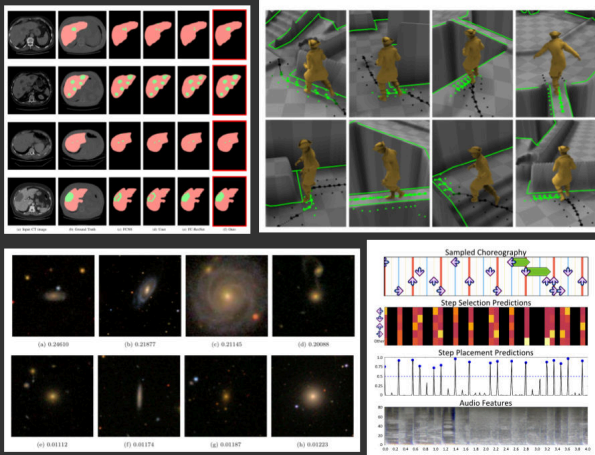


* <http://onlinelibrary.wiley.com/doi/10.15252/msb.20156651/full>



>>> What is Deep Learning?

Deep learning allows computational models composed of several processing layers to learn representations about data with multiple levels of abstraction and, through this, to discover precise representations in large volumes of data autonomously.



>>> Some nice applications examples

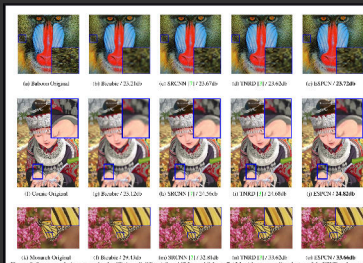
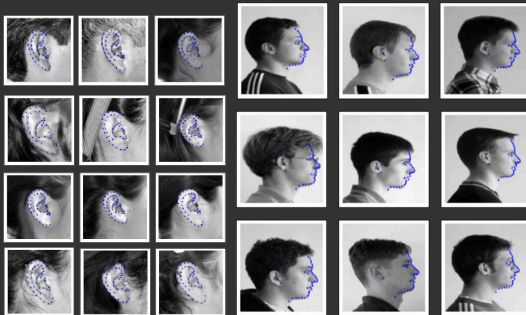
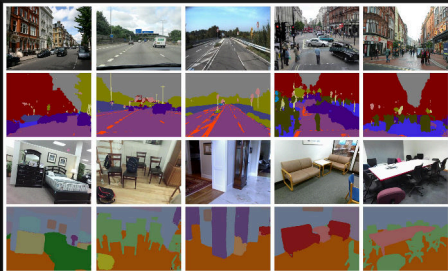


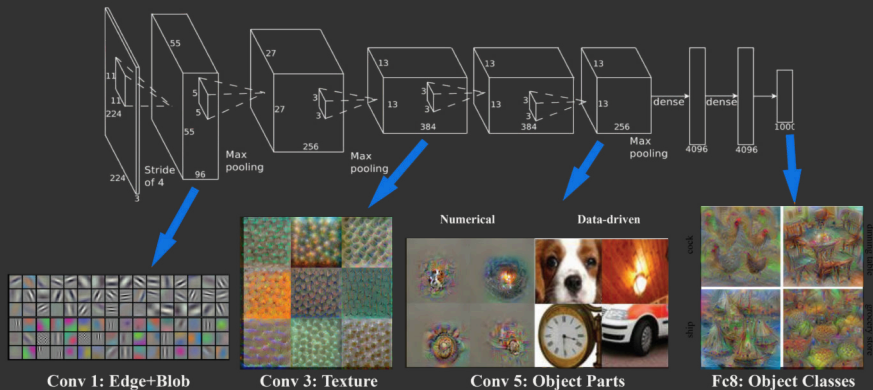
Figure 5. Super-resolution examples for "Baboon", "Corvus" and "Monarch" from *Set5* with an upscaling factor of 3. PSNR values are shown under each sub-figure.





>>> ConvNets

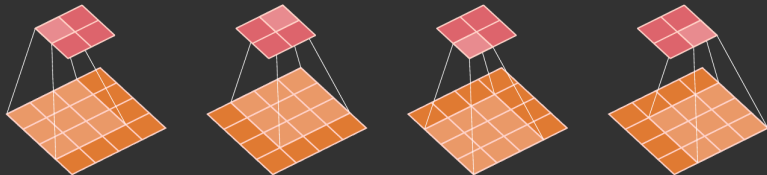
A classic architecture **ConvNet** is given by two stages. The first stage focuses on extracting discriminant characteristics at different levels of abstraction and the second focuses on classification based on the characteristics previously obtained.





>>> Convolution Layer

Important concepts: number of **kernels** and their size, **slide** and **zero padding**.



* A guide to convolution arithmetic for deep learning. Dumoulin, Vincent and Visin, Francesco.



>>> Max-Pooling

Single depth slice

x ↑	1	1	2	4
	5	6	7	8
	3	2	1	0
	1	2	3	4
	y →			

max pool with 2x2 filters
and stride 2

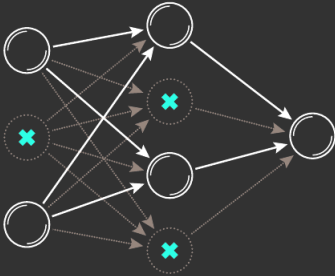


6	8
3	4



* <http://cs231n.github.io/convolutional-networks/#pool>

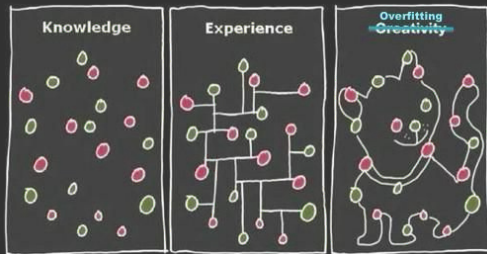
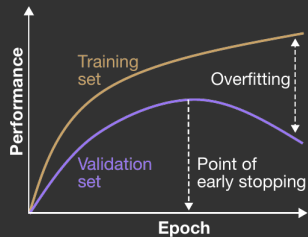
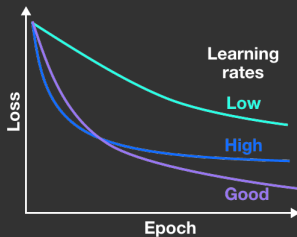
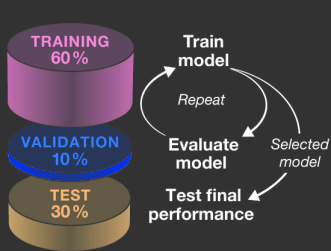
>>> Dropout



* <http://onlinelibrary.wiley.com/doi/10.15252/msb.20156651/full>



>>> Training, Validation and Evaluation



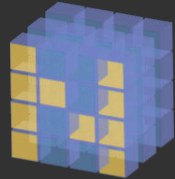


pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$



Lasagne



matplotlib



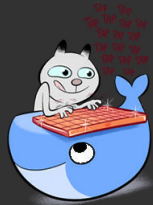
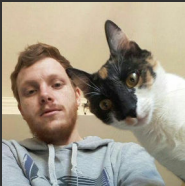


>>> Setup

- * `$ pip install numpy scipy pandas scikit-learn matplotlib`
- * `$ pip install -r https://raw.githubusercontent.com/Lasagne/Lasagne/master/requirements.txt`
- * `$ pip install https://github.com/Lasagne/Lasagne/archive/master.zip`

Or with Docker:

- * `Docker-nvidia` (<https://github.com/NVIDIA/nvidia-docker>)
- * `$ docker pull pablo1n7/tatooine:3.4` or `$ docker pull pablo1n7/tatooine:2.7`



* <https://hub.docker.com/u/pablo1n7/>



>>> Demo Time!





Stereotyping and Bias in the Flickr30K Dataset

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NEURAL ARCHITECTURE SEARCH WITH REINFORCEMENT LEARNING

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Opening the black box of Deep Neural Networks via Information

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PYTORCH

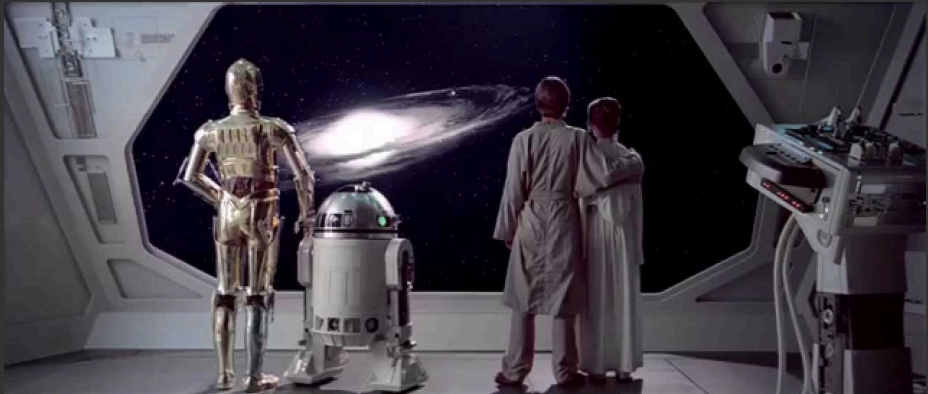
 TensorFlow™



>>> Gracias!



https://github.com/celiacintas/star_wars_hackathon



- * Neural Networks and Deep Learning online book
- * 231n: Convolutional Neural Networks for Visual Recognition
- * Unsupervised Feature Learning and Deep Learning.



>>> Nice papers to read ..

- * Yann, L. (1998). **Efficient backprop**. Neural networks: tricks of the trade (Vol. 53).
- * LeCun, Y., Bengio, Y., & Hinton, G. (2015). **Deep learning**. Nature, 521(7553), 436-444.
- * Dieleman, S., Willett, K. W., & Dambre, J. (2015). **Rotation-invariant convolutional neural networks for galaxy morphology prediction**. Monthly Notices of the Royal Astronomical Society, 450(2), 1441-1459.
- * Hinton, G., Deng, L., Yu, D., Dahl, G. E., Mohamed, A., Jaitly, N., Kingsbury, B. (2012). **Deep Neural Networks for Acoustic Modeling in Speech Recognition**. IEEE Signal Processing Magazine, (November), 82-97.
- * Krizhevsky, A., Sutskever, I., & Geoffrey E., H. (2012). **ImageNet Classification with Deep Convolutional Neural Networks**. Advances in Neural Information Processing Systems 25 (NIPS2012), 1-9.



>>> Nice papers to read .. (Cont.)

- * Srivastava, N., Hinton, G., Krizhevsky, A., Sutskever, I., & Salakhutdinov, R. (2014). **Dropout: A Simple Way to Prevent Neural Networks from Overfitting**. Journal of Machine Learning Research, 15, 1929-1958.
- * Pedregosa, F., & Varoquaux, G. (2011). **Scikit-learn: Machine learning in Python**. Journal of Machine Learning (Vol. 12).
- * Oliphant, T. E. (2007). **Python for Scientific Computing**. Computing in Science & Engineering, 9.
- * Bergstra, J., Bastien, F., Breuleux, O., Lamblin, P., Pascanu, R., Delalleau, O., Bengio, Y. (2011). **Theano: Deep Learning on GPUs with Python**. Journal of Machine Learning Research, 1, 1-48.
- * Badrinarayanan, Vijay; Handa, Ankur; Cipolla, Roberto. **SegNet: A Deep Convolutional Encoder-Decoder Architecture for Robust Semantic Pixel-Wise Labelling**.



>>> Nice papers to read .. (Cont.)

- * Shwartz-Ziv, R., & Tishby, N. (2017). **Opening the Black Box of Deep Neural Networks via Information**. arXiv, 1-19.
- * Simonyan, K., Vedaldi, A., & Zisserman, A. (2013). **Deep Inside Convolutional Networks: Visualising Image Classification Models and Saliency Maps**.
- * Donahue, C., Lipton, Z. C., & McAuley, J. (2017). **Dance Dance Convolution**.
- * Long, J., Zhang, N., & Darrell, T. (2014). **Do Convnets Learn Correspondence?** Advances in Neural Information, 1601-1609.
- * Tompson, J., Jain, A., LeCun, Y., & Bregler, C. (2014). **Joint Training of a Convolutional Network and a Graphical Model for Human Pose Estimation**.
- * Shi, W., Caballero, J., Huszar, F., Totz, J., Aitken, A. P., Bishop, R., ... Wang, Z. (2016). **Real-Time Single Image and Video Super-Resolution Using an Efficient Sub-Pixel Convolutional Neural Network**.