

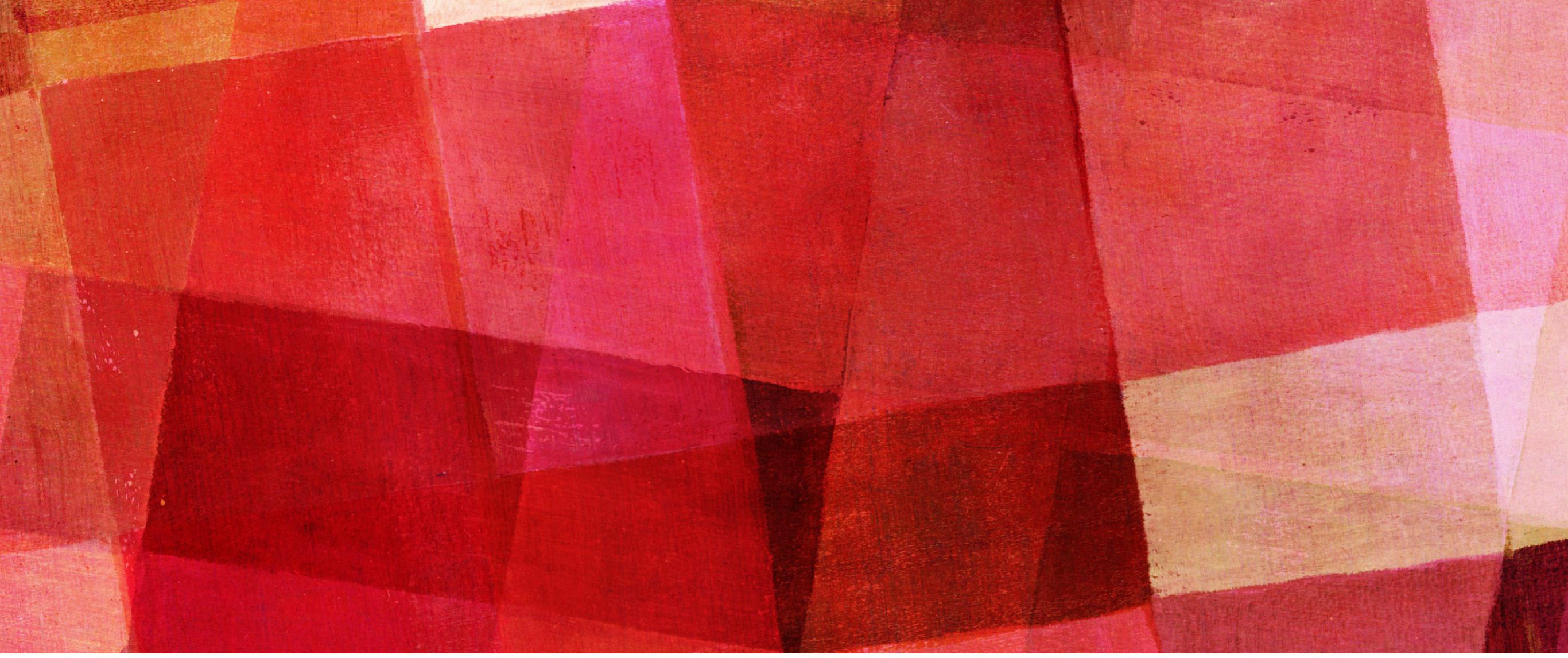
BEFORE FIRST STEP

- Here's the GitHub link of all the codes :
- <https://github.com/mburaksayici/Practical-CNN-Udemy>
- Also, slides corresponding to the chapters are at the first lecture of the chapters.
- Good Luck.



BEYOND MNIST EXAMPLE

Practical Convolutional NNs



INTRODUCTION TO THE CONVOLUTIONAL NEURAL NETWORK AND ITS PRACTICAL PROBLEMS

Questions to the Convolutional Neural Networks

WHAT IS CONVOLUTIONAL NEURAL NETWORK?

- You can find lots of theoretical and practical review of the convolutional neural networks.
- If you are in this course, you probably know what it is.
- In this course we will be mostly talking on the labouring of the convolutional neural networks.

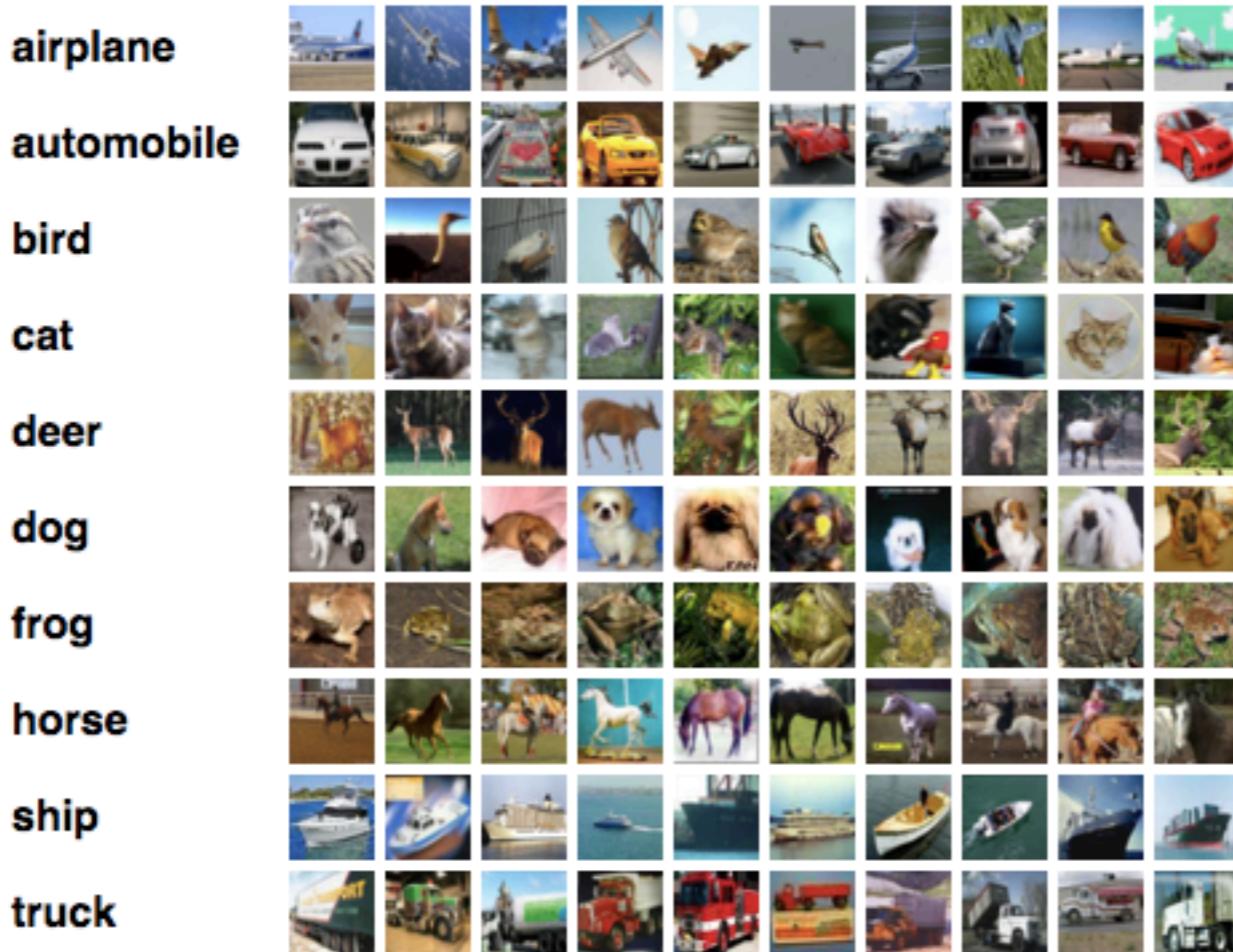
IMAGE CLASSIFICATION



An example training set for four visual categories. In practice we may have thousands of categories and hundreds of thousands of images for each category.

- <http://cs231n.github.io/classification/>
- Four class
- 15 images per each?
- How to label them without effort?

.....
Here are the classes in the dataset, as well as 10 random images from each:



- <https://www.cs.toronto.edu/~kriz/cifar.html>
- Now we have 10 images per each class?
- What about the image sizes?

-
- How to load images to the Python system?
 - Which library should be used?
 - Or can we use libraries?
 - It goes on...

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- We can say that we are not still into practising.
 - We will have more problems on application.



INTRODUCTION TO THE CONVOLUTIONAL NEURAL NETWORK AND ITS PRACTICAL PROBLEMS

*Most Famous Convolutional Neural Networks and
Comparisons*

FIRST TO LATEST

- AlexNet was the revolution.

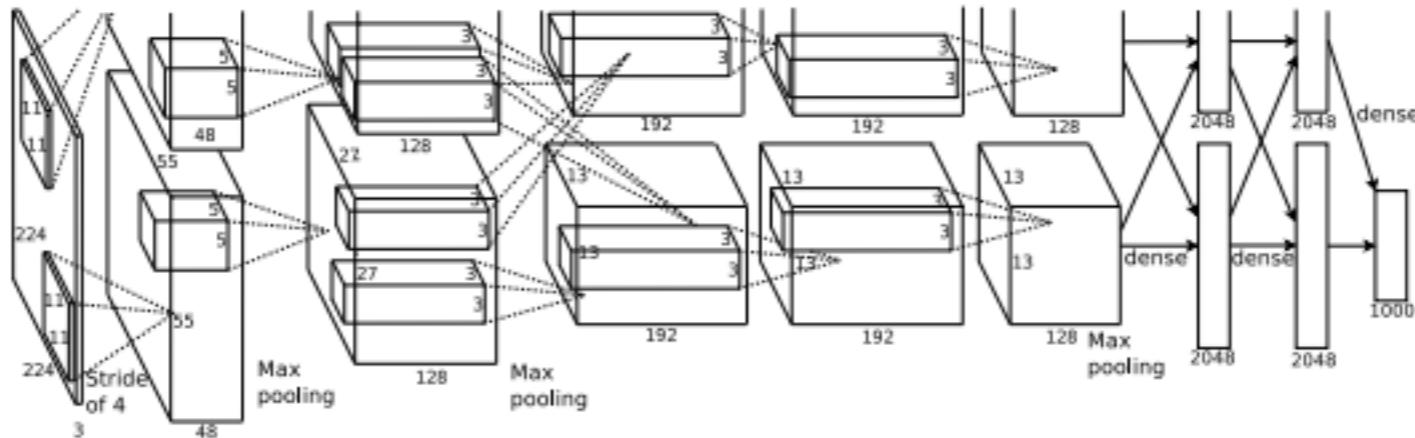
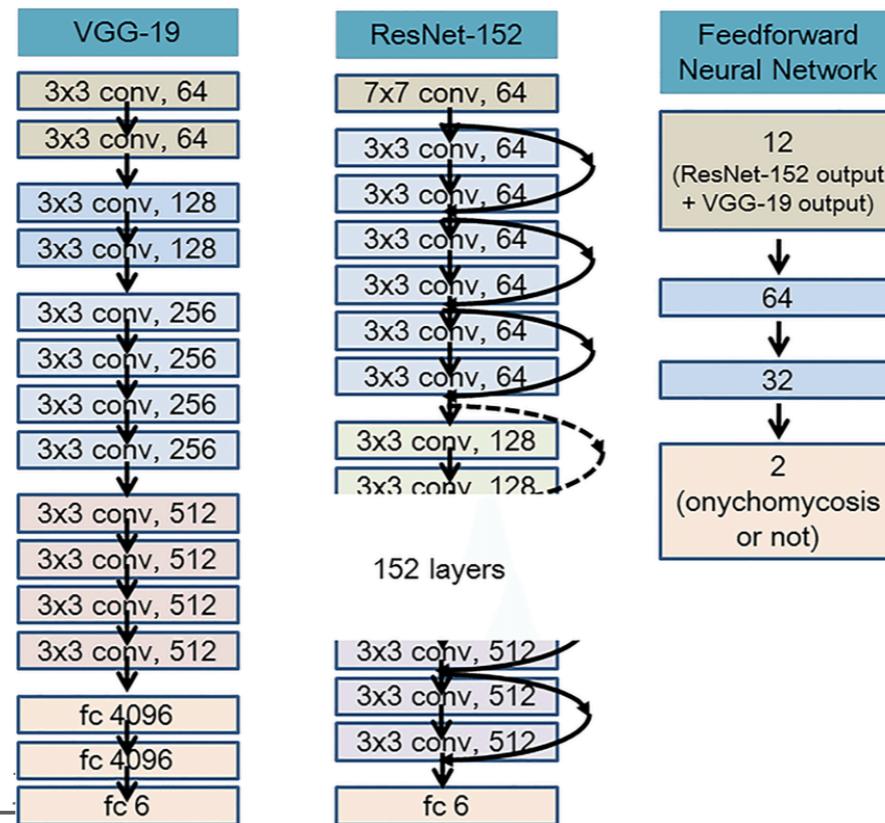


Figure 2: An illustration of the architecture of our CNN, explicitly showing the delineation of responsibilities between the two GPUs. One GPU runs the layer-parts at the top of the figure while the other runs the layer-parts at the bottom. The GPUs communicate only at certain layers. The network's input is 150,528-dimensional, and the number of neurons in the network's remaining layers is given by 253,440–186,624–64,896–64,896–43,264–4096–4096–1000.

- ImageNet Classification with Deep Convolutional Neural Networks, Alex Krizhevsky, Ilya Sutskever, Geoffrey E. Hinton
- 8 Layers, Accuracy of 0.569 (Top-1)

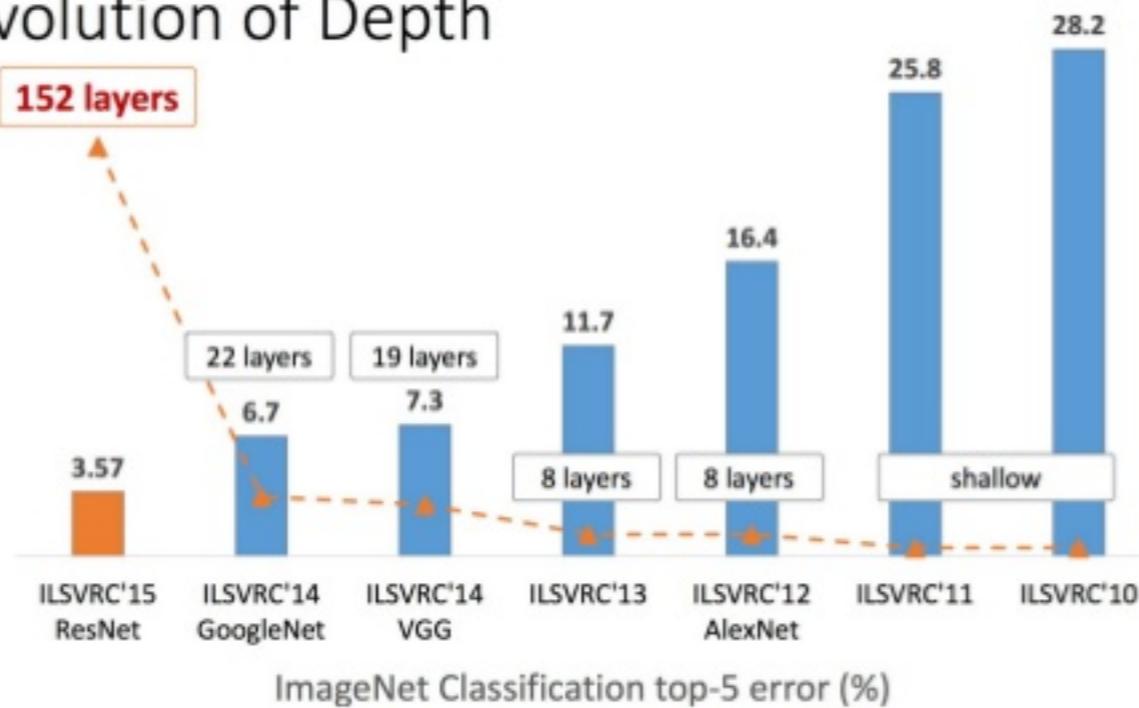
► ResNet-152, What is that number?



- Image from: (Deep superior performance to dermatologists in onychomycosis diagnosis: Automatic construction of onychomycosis datasets by region-based convolutional deep neural network)
- 152 Layers, Accuracy of 0.786 (Top-1)

E2E: Classification: ResNet

Revolution of Depth



He, Kaiming, Xiangyu Zhang, Shaoqing Ren, and Jian Sun. "Deep Residual Learning for Image Recognition." *arXiv preprint arXiv:1512.03385* (2015). [\[slides\]](#)

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- Image Credit : Kaiming He <http://kaiminghe.com/>

-
- Do ImageNet Results can be advisor for your smaller projects?
 - 1000 Classes
 - Millions of Images



INTRODUCTION TO THE CONVOLUTIONAL NEURAL NETWORK AND ITS PRACTICAL PROBLEMS

What is MNIST Dataset?

-
- The MNIST database of handwritten digits, available from this page, has a training set of 60,000 examples, and a test set of 10,000 examples. It is a subset of a larger set available from NIST. The digits have been size-normalized and centered in a fixed-size image. (<http://yann.lecun.com/exdb/mnist/>)

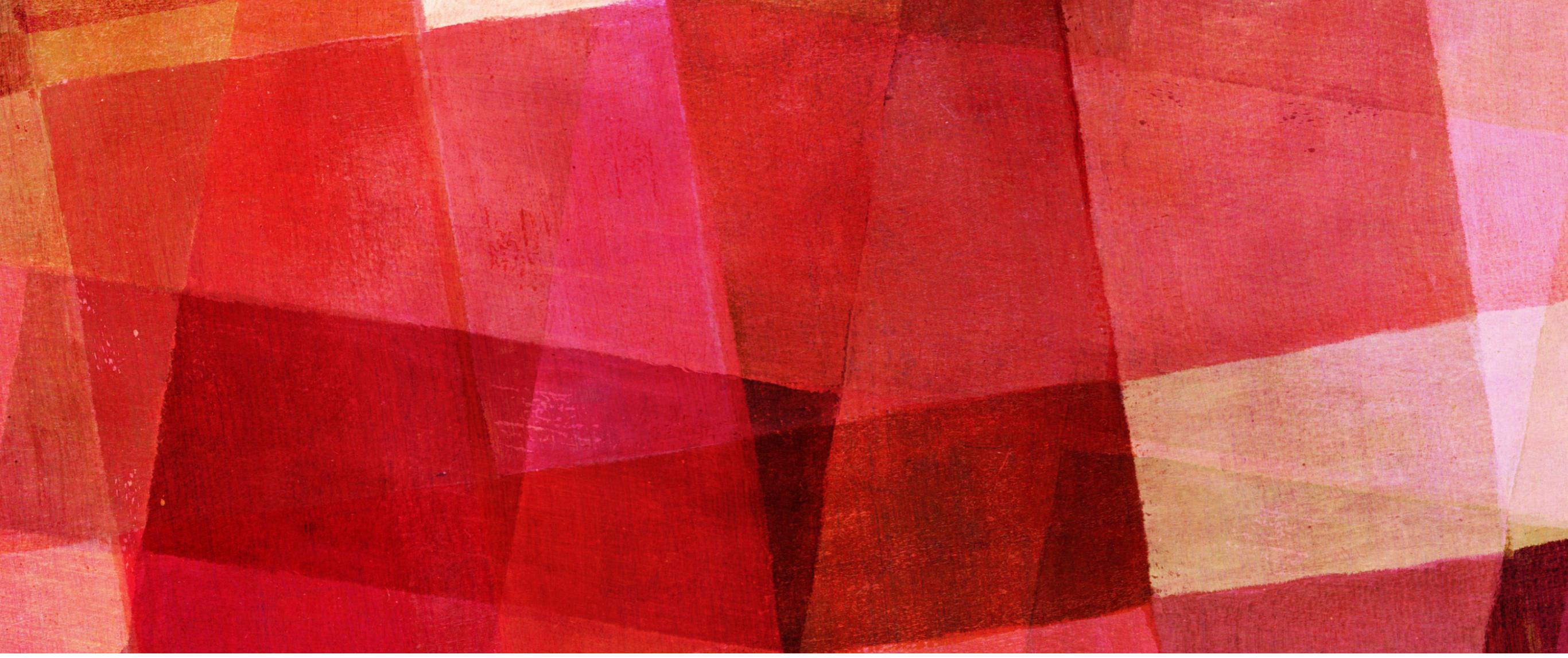


-
- 6000 training images per each number(0-9).
 - 1000 test images per each number(0-9).
-
- You all know it.



INTRODUCTION TO THE CONVOLUTIONAL NEURAL NETWORK AND ITS PRACTICAL PROBLEMS

*First Convolutional Neural Networks Application: MNIST
Example with Keras*



INTRODUCTION TO THE CONVOLUTIONAL NEURAL NETWORK AND ITS PRACTICAL PROBLEMS

What are those untold secrets of MNIST Example?

```
.....  
(x_train,y_train), (x_test,y_test) =mnist.load_data()# Is it that easy to load the dataset?
```

- How will we load the data to the Python?
- NumPy
- SciPy
- OpenCV
- Keras' function
- PIL

```
.....  
img_rows, img_cols = 28,28 # What is the standart of the pixels? Do these images must have the same pixels? 299x299 224x224
```

- We will talk about pixel size of images.
- There exist a standart for image size.
- However, while collecting data, we don't have to find ie. 299x299 images of that class, we can resize images by
 - SciPy
 - OpenCV
 - Keras' function
 - PIL

-
- We can handle also labeling easily with Keras.

```
y_train = keras.utils.to_categorical(y_train,num_classes)
y_test = keras.utils.to_categorical(y_test,num_classes)
) # One Hot encoding method.
#600000,28,28,1
#600000,26,26,1
#600000,24,24,1
#600000,12,12,1
#600000,12,12,1
) #600000x12x12x1
```

-
- We will find the right architecture for the

```
model = Sequential()

model.add(Conv2D(32,kernel_size=(3,3),activation="relu",input_shape=(28,28,1)))
model.add(Conv2D(32,kernel_size=(3,3),activation="relu"))
model.add(MaxPooling2D())
model.add(Dropout(0.5))
model.add(Flatten())
model.add(Dense(128,activation="relu"))
model.add(Dropout(0.5))
model.add(Dense(num_classes,activation="softmax"))

print(model.summary())

# Finding quick solutions to the choosing the right architecture for our dataset.
# Fine Tuning / Transfer Learning
```

Type: In word "learning" more /APC11

- Transfer Learning
- Fine Tuning
- Fast, High Accuracy

-
- We have very balanced data in MNIST,

```
# 10 classes, training 60000/10 - 6000 images per each class  
# Imbalanced Dataset
```

- Every class has the same number of images.
- What about real world?
- We will solve it with,
- Class Weight with Scikit Learn,
- Sample Weight with Scikit Learn,
- And also we will talk about the Image Augmentation

-
- Image Augmentation, there are lots of libraries.

```
# Image Augmentation - balances the data with creating artificial data. 100000 , 1000 + 9000
```