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Facial Recognition Using Convolutional Neural Networks

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The best results in the field of facial recognition were shown by Convolutional Neural Network or CNN which is logical development of ideas of such architecture of NN as kognitrona and neokognitrona.

Testing of CNN on the ORL database containing images of persons with little changes of lighting, scale, space turns, situation and different emotions has shown 96% recognition accuracy. CNN was primary used by DeepFace in Facebook for facial recognition of the users of the social network [1].

How does CNN recognize faces? It consists of 4 major steps.

The first step is face detection. Face detection went mainstream in the early 2000's when Paul Viola and Michael Jones invented a way to detect faces that was fast enough to run on cheap cameras. But nowadays there are much more reliable solutions. We're going to use a method invented in 2005 called Histogram of Oriented Gradients – or just *HOG* for short [2].

We'll look at every single pixel in our image one at a time. Our goal is to figure out how dark the current pixel is comparing to the pixels that surround it. Then we want to draw an arrow showing in which direction the image is getting darker. But saving the gradient for every single pixel gives us way too much information. To do this, we should break up the image into small squares of 16 by 16 pixels each. Then we'll replace that square in the image with the arrow directions that were the strongest.

The second step is posing and projecting faces. We are going to use the algorithm called **face landmark estimation**. The basic idea is that we should identify 68 specific points (called *landmarks*) that exist on every face. Then we will train a machine to find these 68 specific points on any face.

The third step is encoding faces. It turns out that the obvious measurements to us (like eye color) don't really make sense to a computer. Researchers have discovered that the most accurate approach is to let the computer figure out the measurements to collect. Deep learning does a better job than humans at figuring out which parts of a face are important to measure.

The last step is finding the person's name from the encoding. All we have to do is to find a person in our database of known people who has the closest measurements to our test image. You can do that by using any basic machine learning classification algorithm [3].

References:

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