Cascade Classifier

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Original author	Ana Huamán
Compatibility	OpenCV >= 3.0

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Goal

In this tutorial,

- We will learn how the Haar cascade object detection works.
- We will see the basics of face detection and eye detection using the Haar Feature-based Cascade Classifiers
- We will use the **cv::CascadeClassifier** class to detect objects in a video stream. Particularly, we will use the functions:
  - **cv::CascadeClassifier::load** to load a .xml classifier file. It can be either a Haar or a LBP classifier
  - **cv::CascadeClassifier::detectMultiScale** to perform the detection.

Theory

Object Detection using Haar feature-based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones in their paper, "Rapid Object Detection using a Boosted Cascade of Simple Features" in 2001. It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images.

Here we will work with face detection. Initially, the algorithm needs a lot of positive images (images of faces) and negative images (images without faces) to train the classifier. Then we need to extract features from it. For this, Haar features shown in the below image are used. They are just like our convolutional kernel. Each feature is a single value obtained by subtracting sum of pixels under the white rectangle from sum of pixels under the black rectangle.