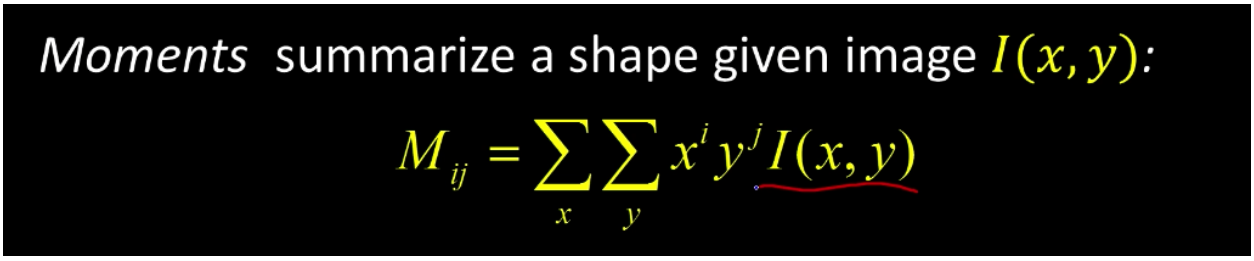
Tarea 2.4

What are the invariant moments?

- An invariant moment or “image moment” are a summarize of a given image shape.
  The ij moments are the sum of the XY image of X raised to the i power and Y to the j power times the Image at XY where the image is non zero.

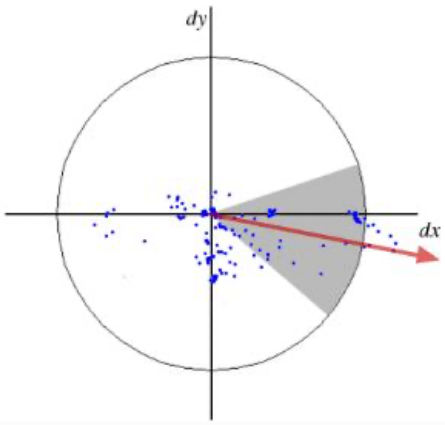


What algorithms exist to extract features in images?

- There are many algorithms for feature extraction, most popular of them are SURF, ORB, SIFT, BRIEF. Most of these algorithms based on image gradient. Basically, those algorithms cached the image blobs by different approaches, most of them related with

SURF:

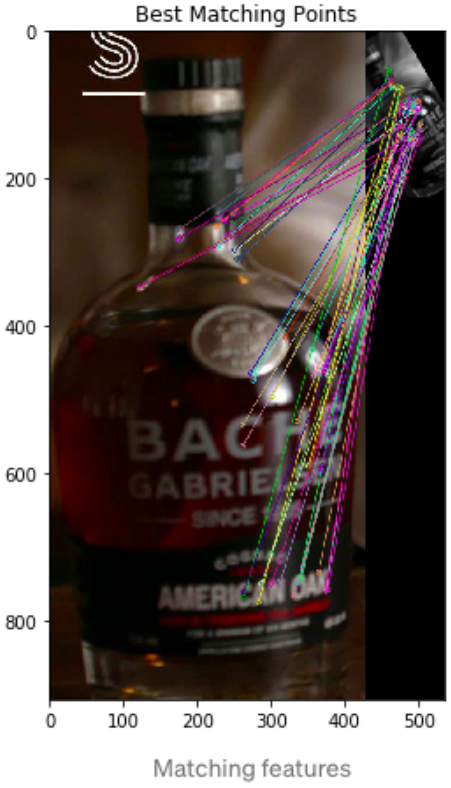
For orientation assignment, SURF uses wavelet responses in horizontal and vertical direction for a neighbourhood of size 6s. Adequate guassian weights are also applied to it. Then they are plotted in a space as given in below image. The dominant orientation is estimated by calculating the sum of all responses within a sliding orientation window of angle 60 degrees.



For feature description, SURF uses Wavelet responses in horizontal and vertical direction (again, use of integral images makes things easier). A neighbourhood of size 20sX20s is taken around the keypoint where s is the size. It is divided into 4x4 subregions. For each subregion, horizontal and vertical wavelet responses are taken and a vector is formed like this,
$v = (\sum d_x, \sum d_y, \sum |d_x|, \sum |d_y|)$. This when represented as a vector gives SURF feature descriptor with total 64 dimensions. Lower the dimension, higher the speed of computation and matching, but provide better distinctiveness of features.

ORB:

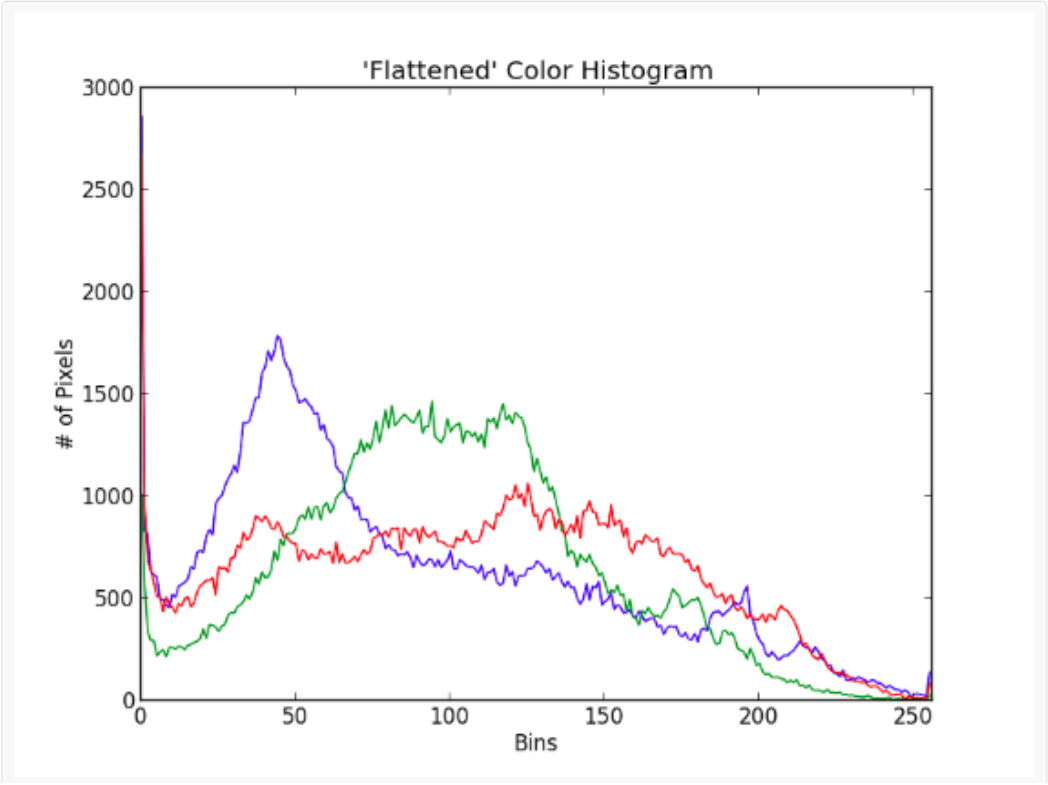
ORB essentially finds the “corners” of the image. The FAST component identifies features as areas of the image with a sharp contrast of brightness. If more than 8 surrounding pixels are brighter or darker than a given pixel, that spot is flagged as a feature. Now that we have detected our features, we must express them. BRIEF does this by converting the extracted points as binary feature vectors. These are strings of 128–526 0s and 1s. ORB is pretty useful.



Color gradient histogram:

This method simply measures the proportions of red, green, and blue values of an image and finds an image with similar color proportions. Color gradient histograms can be tuned primarily through binning the values.

This method is fine, but it isn't very detailed. If you query and image with blue skies, it can return ocean images, or images of a pool. Think of it like the color feature in Google Image Search.



Vantage point tree:

A VP-Tree is great if you're trying to find duplicate images in a database. This algorithm is able to find identical images to the query image, or near-identical images.

This method essentially analyzes the contents of an image and compresses all that information in a 32-bit integer. Theoretically, the images that have similar compositions would be ordered similarly, and would be neighbors based on composition. This is called hashing.