FACE RECOGNITION

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What is Face Recognition?

- A **face recognition system** is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source.

- One of the ways to do this is by comparing selected facial features from the image and a face database.

- It is a complex process and challenging because it needs to detect faces which are not rigid and have a high degree of variability in size, shape, color and texture.

Difference in Face Detection and Face Recognition

Face Detection

- Where is the face?

Face Recognition

- Who is this person?

Applications of Face Recognition

- Criminal Identification
- Biometric security system
- Image and film processing
- Gaming
- Tagging
- Image search
- Human computer interaction

Viola Jones Approach

- 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**.
- The technique was both robust and very quick (15% faster than any techniques available at that time).
- It gives 95% accuracy at around 17fps
- It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images.

Viola Jones Approach

AI Section

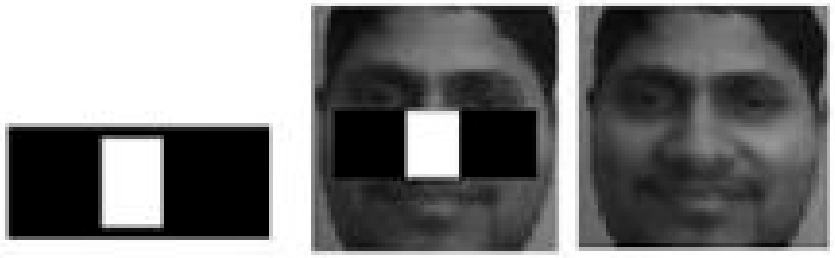
- Learning based on AdaBoost(Adaptive Boost) Algorithm
- Classifier cascade

Recognition Section

- Integral Image
- Haar like features

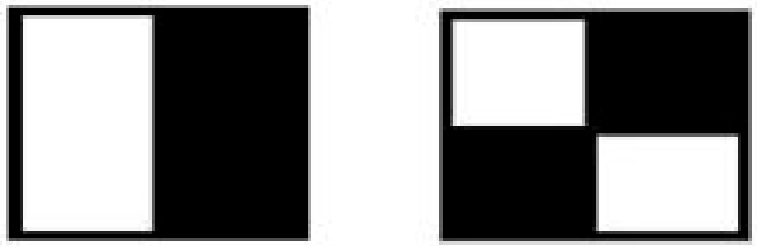
Haar Features

- Haar Features – All human faces share some similar properties. These regularities may be matched using **Haar Features**.
- A few properties common to human faces:
- The eye region is darker than the upper-cheeks.
- The nose bridge region is brighter than the eyes.
- Location and size: eyes, mouth, bridge of nose
- Value: oriented gradients of pixel intensities
- The four features matched by this algorithm are then sought in the image of a face (shown at left).
- Rectangle features:
- Value = Σ (pixels in black area) - Σ (pixels in white area)
- Three types: two-, three-, four-rectangles, Viola & Jones used two-rectangle features
- For example: the difference in brightness between the white &black rectangles over a specific area
- Each feature is related to a special location in the sub-window



Haar Feature that looks similar to the bridge of the nose is applied onto the face

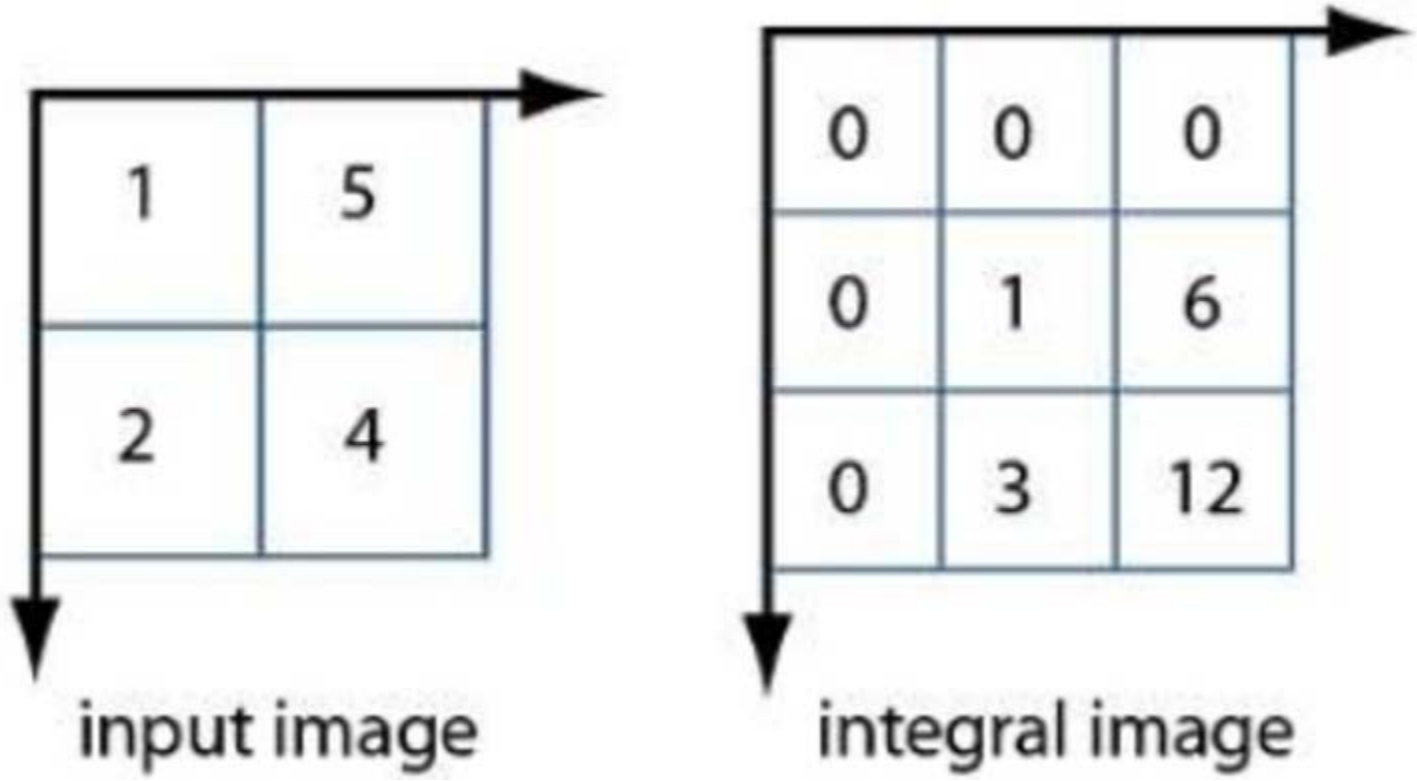
Haar Feature that looks similar to the eye region which is darker than the upper cheeks is applied onto a face



3rd and 4th kind of Haar Feature

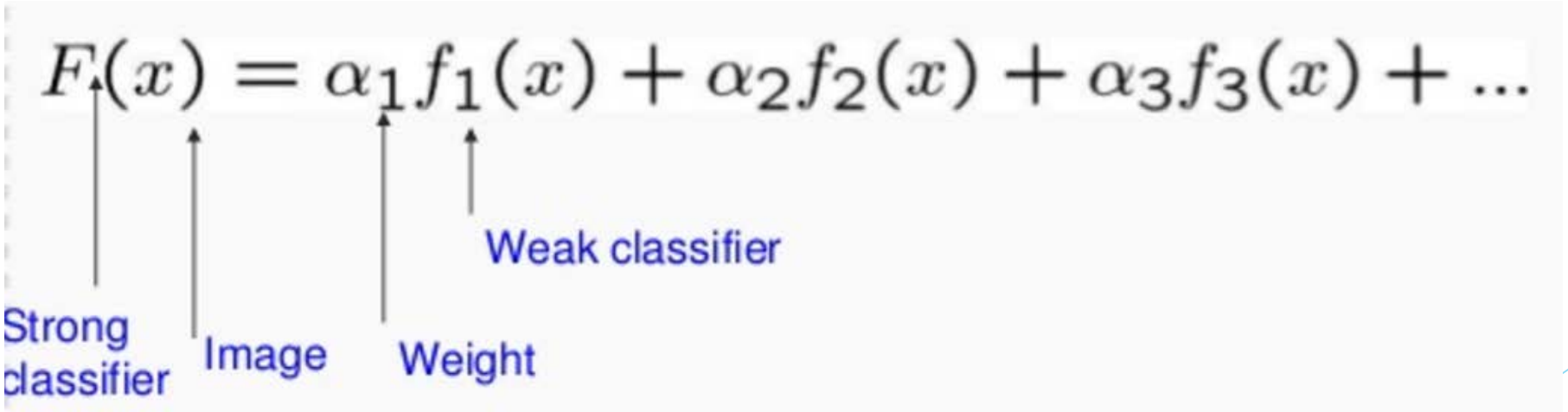
Integral Image

- New image representation which allows the features used by our detector to be computed very quickly.



AdaBoost Algorithm

- Stands for Adaptive Boost
- Constructs a strong classifier as a combination of weighted simple weak classifiers.
- Each single rectangle feature may be regarded as a simple weak classifier.
- It is an **“iterative algorithm”** which performs a series of trials, each time selecting a new weak classifier.



Conclusion

- Facial detection is influenced by clarity of the image , colored or black and white image .
- It can only support frontal detection of images.
- The training does takes a lot of time in order to separate a negative face from a positive face.
- Using Adaptive boost algorithm and cascading helps in faster detection.

THANK YOU