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Intro

Haar Features

* Essential for large feature extraction
* Identifies features by aligning with dark and light sections
* More and 160,000 features!

Adaboost

* Creates a detector by learning which few Haar features are best
* Requires many training images, which humans have already labeled
* Start with a bunch of weak classifiers
* We choose a number of training rounds. Every round we select the weak classifier that was most accurate.
* Next round the harder pictures are emphasized, to refine the classifier.
* At the end we combine the best weak classifiers from every round into a strong classifier.

Cascaded Classifiers

* Used to increase speed when looking for a face (in a non close up)
* “Instead of finding faces, the algorithm should discard non-faces.” Faster to discard non-face than find face.
* A cascaded classifier is a cascade of strong classifiers (layers).
* Early layers are quick to evaluate but only give “maybe a face” and “definitely not a face”. If “definitely not a face” we can discard that sub-window.
* Later layers take longer, but usually unnecessary.
* Each layer has a very high detection rate, but consequently a high false positive rate
* Not actually a huge problem. Ex: 10 layer detector, each layer has false positive rate 30%, but 0.302 = 9%, so 0.3010 = 6\*10-4%.

Detection Results

PCA

Possible Applications

* Skin Cell: Patterned, but still have large features
* Unhealthy cells might be less patterned.

Possible Questions

* What do your detection results mean?
* So *this* is how snapchat filters work!?!?
  + Yes.
* Can this be Used in security applications?
  + Yes, but there are better algorithms for that. We chose Viola-Jones for its transparency.
* Why are you trying to detect faces when people have already figured out how to do that?
  + We are not trying to make novel progress in the area of face detection. However, it is important for us to understand large feature extraction algorithms, of which this one is transparent and well understood.
* How do you know when a Haar feature has done a good job?
  + The computer is actually comparing the pixels underneath the Haar feature. The black rectangle should be over a dark part of the face, and the white rectangle should be over a light part. We then take the difference of the total pixel intensities under these parts.