Facial Keypoint Detection

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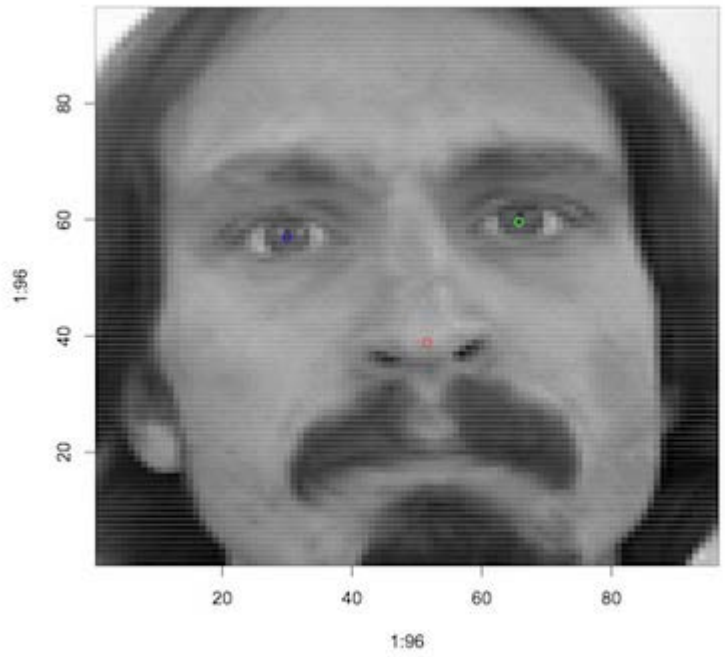
Training Dataset

Consists of 7,049 96x96 gray-scale images

Each has 15 attributes(locations for keypoints)

- right_eye_center / left_eye_outer_corner /…



An example of one of the faces with three keypoints marked.

Goal

Predict a facial keypoint location for each test image

Only need 1-dimensional information(x or y) for the requested keypoint

	A	B	C	D
1	RowId	ImageId	FeatureName	Location
2	1	1	left_eye_center_x	65
3	2	1	left_eye_center_y	39
4	3	1	right_eye_center_x	32
5	4	1	right_eye_center_y	39
6	5	1	left_eye_inner_corner_x	57
7	6	1	left_eye_inner_corner_y	39
8	7	1	left_eye_outer_corner_x	72
9	8	1	left_eye_outer_corner_y	39
10	9	1	right_eye_inner_corner_x	38
11	10	1	right_eye_inner_corner_y	39
12	11	1	right_eye_outer_corner_x	24
13	12	1	right_eye_outer_corner_y	40
14	13	1	left_eyebrow_inner_end_x	55

Score Evaluation

Root Mean Squared Error (RMSE)

$\hat{y}_i$: predicted value y_i : original value

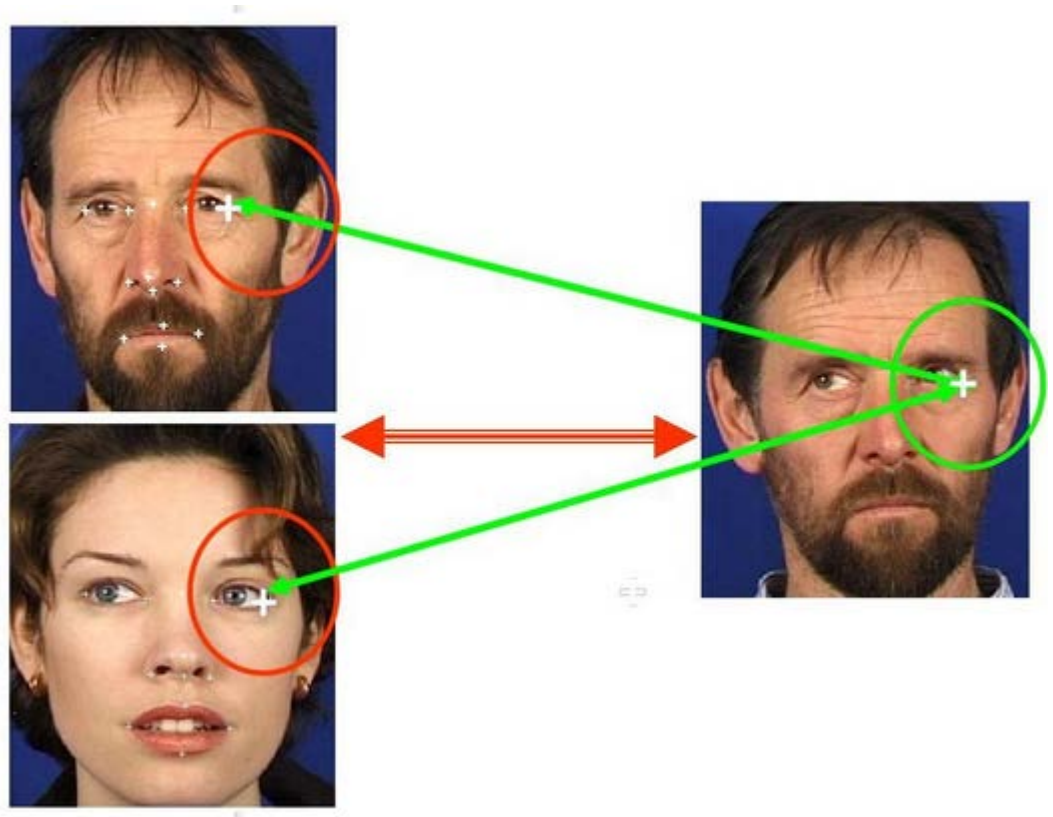
$$\mathrm{RMSE} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}$$

Keypoint Detection in R

USING IMAGE PATCHES

Patch Definition

The area around a keypoint



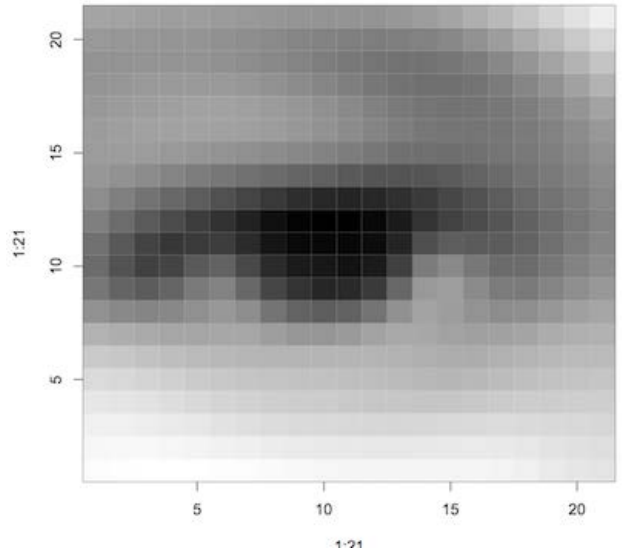
Averaged Patches Method - Parameters

Patch Size

- #(pixels) we are going to extract in each direction around the center of the keypoint

Search size

- #(pixels) we are going to move in each direction when searching for the keypoint



Averaged Patches Method - Procedure

1. For each keypoint feature on training images, compute the *average patch*
2. For each feature on each test image, *find the position* that best correlates with the average patch
   - Search the area near the mean position of training data
   - Use the point in the region as center points for patches
   - Calculate the *correlation* with the *average patch* (using matrix correlation function)
   - Choose the points with the highest correlation as keypoints on test images

Experimenting with Different Patch Sizes

Patch size	Search size	RMSE
8	2	3.85282
10	2	3.80685
12	2	3.77756
14	2	3.75538
16	2	3.76593
10	1	3.86137
10	3	3.86137

15th place on public leaderboard

Q & A