Visual measurement of jackets by structured prediction

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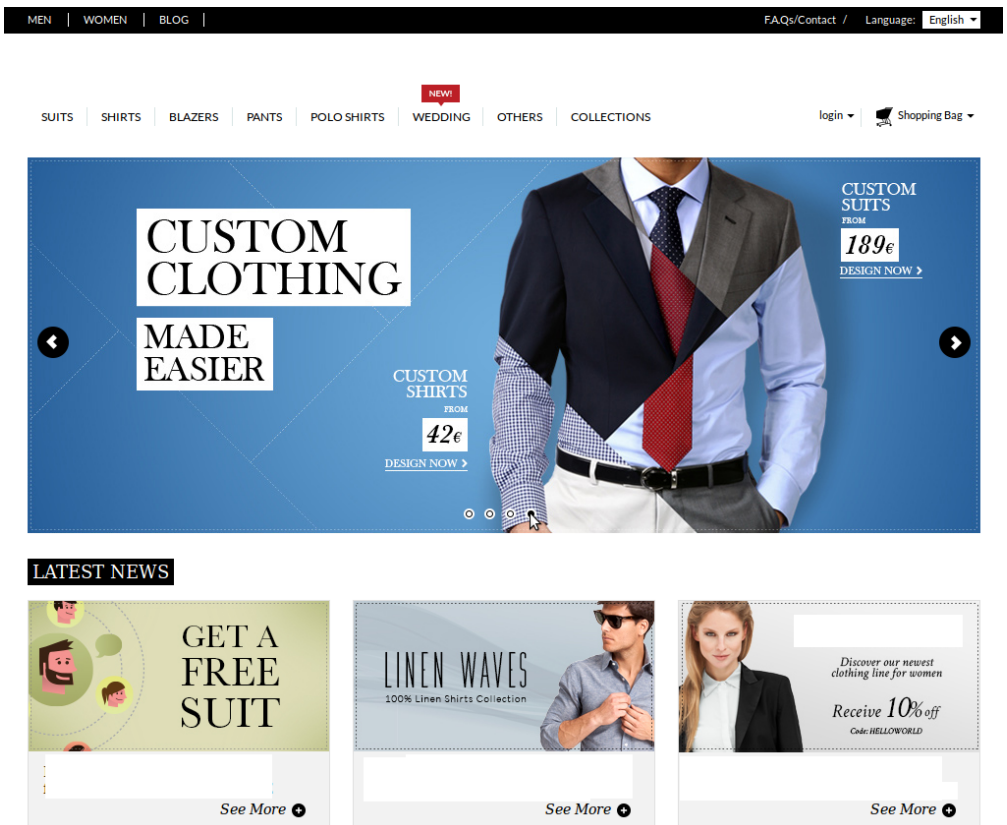
Problem

A company sells jackets custom tailored to the sizes specified by their clients through its website.



Problem

Sometimes customers return items complaining they don't fit well.
Causes :

- customers don't measure themselves well with a tailor tape
- input wrong measures to the web page
- tailor had a bad day
- ??

There's a need for comparing the actual measures of an item with those provided by customers.

Goal

Perform automatic measurements on each garment at *pre-shipment time* for quality control, by means of computer vision techniques.

Problem

What to measure

Image capture

Samples

We captured a first set of 23 jackets as working samples, from which

- 16 normal color, style, size
- 7 less frequent

Normal samples

1

2

3

4

5

6

Normal samples

7

8

9

10

11

12

Normal samples

13

14

15

16

Less frequent samples

17

18

19

20

21

22

Less frequent samples

23

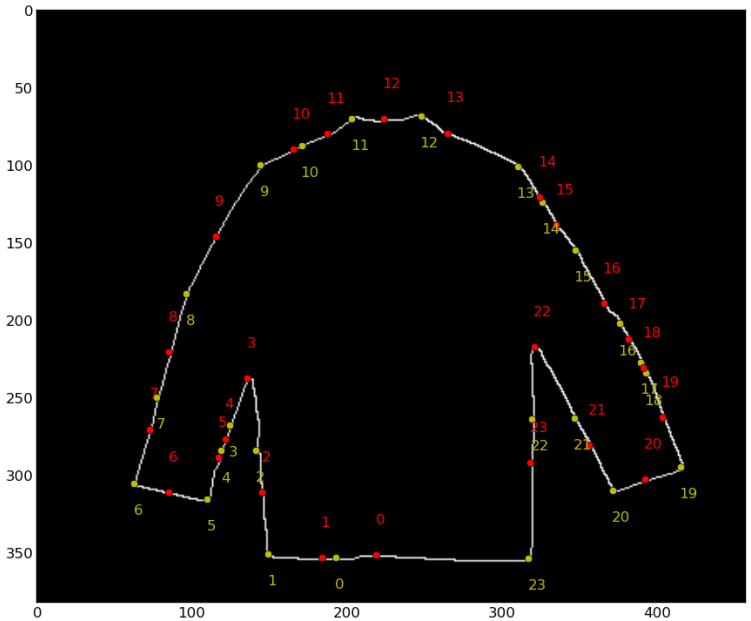
Later we received a second set of 82 more images for which we made an additional groundtruth file.

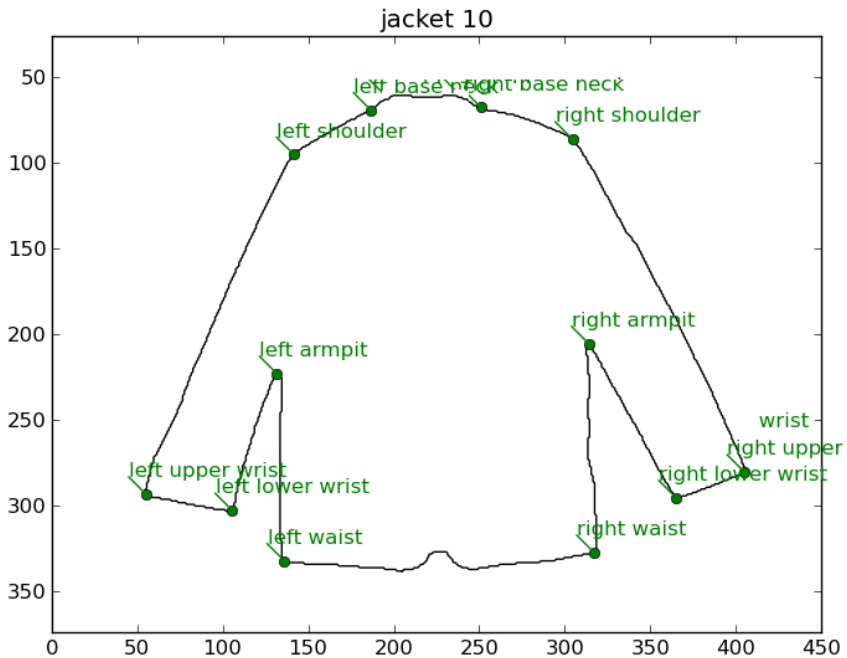
Method

1. Segmentation
2. Extract contour

Method

3. contour → curvature → extrema points → keypoints





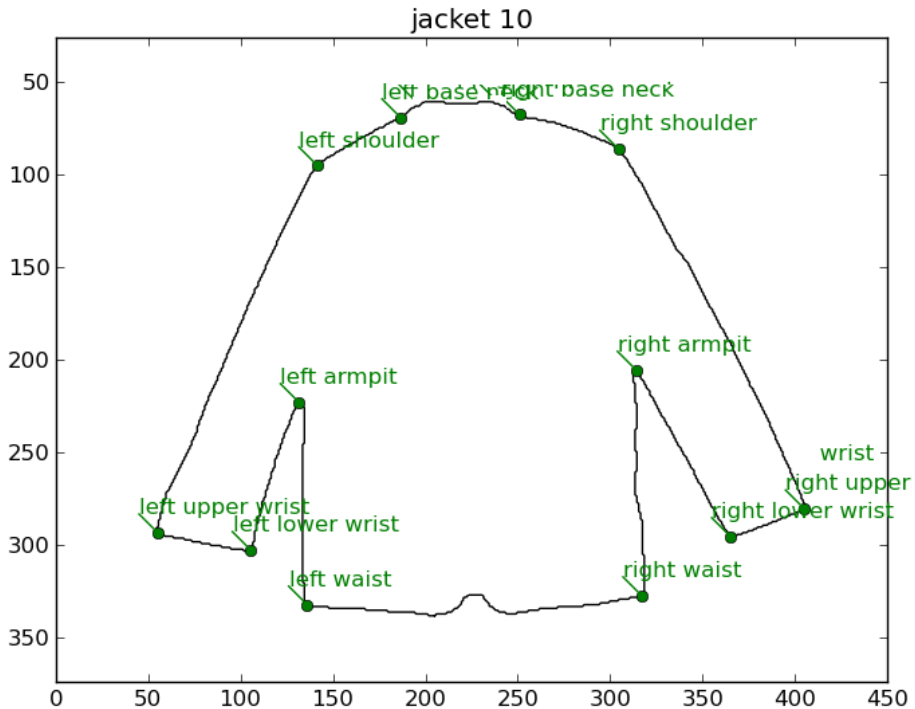
yellow = maxima / convex

red = minima / concave

Method

3. contour → curvature → extrema points → keypoints

```
labels_extrema = {
   0: 'not a keypoint',
   1: 'left base neck',
   2: 'left shoulder',
   3: 'left upper wrist',
   4: 'left lower wrist',
   5: 'left armpit',
   6: 'left waist',
   7: 'right waist',
   8: 'right armpit',
   9: 'right lower wrist',
  10: 'right upper wrist',
  11: 'right shoulder',
  12: 'right base neck'
  }
```

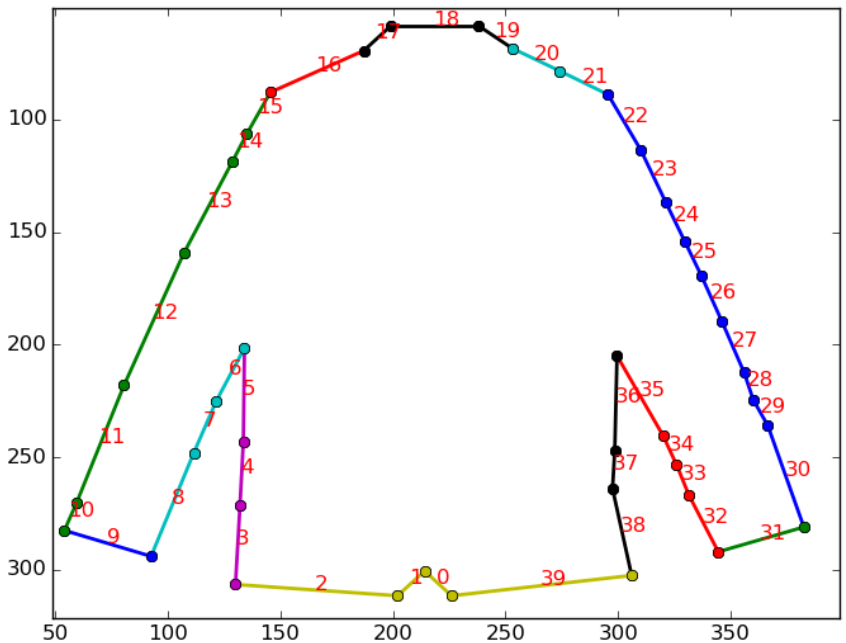


Method

or

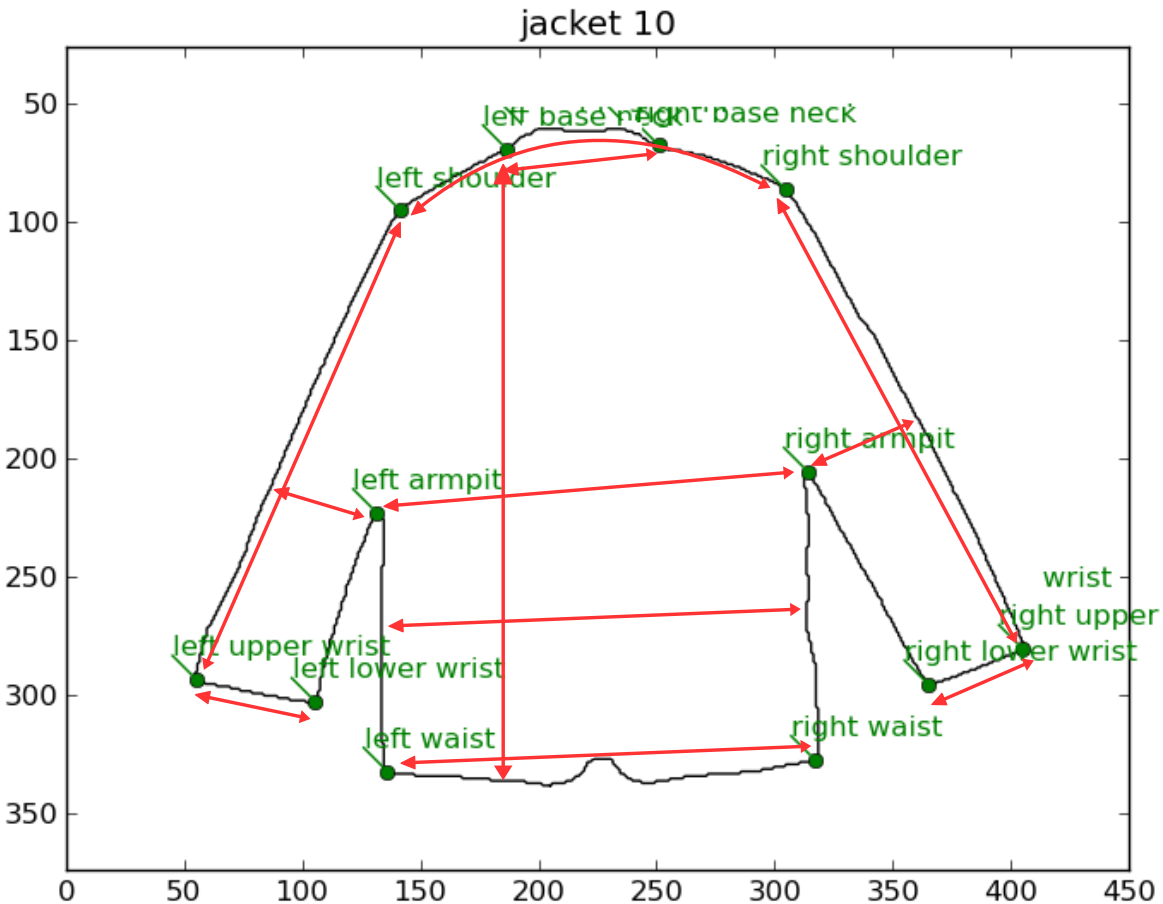
3. contour → curvature → extrema points → segments → keypoints

```
labels_segments = {
   0: 'neck',
   1: 'left shoulder',
   2: 'outer left sleeve',
   3: 'left wrist',
   4: 'inner left sleeve',
   5: 'left chest',
   6: 'waist',
   7: 'right chest',
   8: 'inner right sleeve',
   9: 'right wrist',
  10: 'outer right sleeve',
  11: 'right shoulder',
  }
```



Method

4. keypoints $\longrightarrow$ measures



Method

What should we label = classify to then get the keypoints ?

- curvature extrema, or
- segments between curvature extrema

What has a more constraining context ? (see the labels in each case)

What to do

Given

- segments plus some precomputed features
- groundtruth = type of each segment

for each jacket, **learn a segment classifier** (no need to obtain keypoints, it's direct)

What to do

1. design a **graphical model** to infer the class of each segment, making the most of the structured nature of the problem
2. train it = **learn** its parameters, trying a few different ssvm learning algorithms
3. perform structured prediction as **inference** on it
4. **evaluation** with kfold=5 on jackets (23 for learning, 4 for testing)
5. compare performance with classification by standard linear SVM
6. **explain** results

Tools, data & code

- Python + some IDE (for example Windows: Python(x, y), Windows/Linux: Anaconda)
- scikit-learn for linear SVM and cross-validation
- Panda or cvs to load Excel spreadsheets
- Pystruct + dependencies (CVXOPT, qpbo)
- Pystruct OCR letter recognition example !
- segments for 23 jackets, groundtruth and template script

Grading

- C = 0 points : code does not work or performs bad, doesn't learn a GM
- B = 0.5 points : it works and performs well (like >95% accuracy) with the first set of 23 samples + comparison with linear SVM + good discussion of results
- A = 1 point : B + add second set of 82 samples + experiment with different sets of features. Caution, new images were not recorded by us, some are problematic.

Deliverables

Each group sends to `joans@cvc.uab.es`

- the source code, that can or not be based on the template we provide, plus 10-15 slides in PDF or so, with
- quantitative + qualitative results
- discuss results : when does it work ? when not ? comparison
- all in a single zip file

Include names of group members and NIU in the email text.