

COL783 – Digital Image Processing

Assignment-2: Image Morphing and Bilateral Filtering

Feature Detection

1. Feature Detection Pipeline

- a. We convert the source image to binary image in colour space. Intuition for this step was based on capturing the skin colour in frontal face image.
- b. To convert into binary image we run median cut algorithm and quantize the region into two prominent colours. One colour thus will naturally be skin colour (Because of this step, we assume the image is frontal face image and doesn't contain distractions about other objects)
- c. We segment the binary image to extract the face removing the background. Removal of background is done on the basis of other colour in binary image.
- d. We now try to do contour fitting on this image to crop the image to boundary of the face. This is done by approximating elliptical/oval contour on face. Thus we only keep the region falling inside the ellipse and remove everything lying outside ellipse. This yields cropped image.
- e. We now do edge detection on this cropped image to identify features mainly eyes, nose (nostrils) and lips. We use difference of Gaussian combined with hysteresis step of canny edge detection. This step has many controllable parameters which can be fine-tuned by user. (To completely automate we have to use Machine Learning algorithms which is out of scope of this course)
- f. Finally on detected edges, we try to find the patterns of eyes, nose and lips. We have approximated:
 - i. Eyes - circle/ellipse
 - ii. Nose – circle/ellipse
 - iii. Lips – line/ellipse

- g. We differentiate similar patterns on the basis of area and position. Larger the area more is probability of it being eyes. Smaller the area more is probability of it being nose.
- h. We also differentiate patterns on basis of height of occurrence of detected feature. If feature is detected at highest level is eye-lids/eyes. Lesser the height, more is probability of it being lips.

2. Limitations

- a. We assume the image is frontal face image without much distractions. This is due to our assumption that skin colour is prominent in image.
- b. This method won't work in case of close eyes, smiling image and narrow (closed) nostrils because we are approximating it with ellipse and circle. In above cases, approximation won't work and some other feature present in image would be considered as eyes.
- c. In case where background matches skin colour, our method doesn't yield accurate results. We require background to be other than skin colour.
- d. Narrow eyes, narrow nostrils are difficult to detect in our pipeline. But we have provided parameters which user can tweak to get better results in such cases.

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