Motion Blur Detection
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Blur in Images

There are two main types of blur:

- Out of Focus
- Motion Blur
Motion Blur

Motion blur is usually created when the time of exposure is long relatively to the velocity of movement.
Motion Blur

Typically, motion blur creates smoothness in the image on the direction of movement, and many edges in the vertical direction.
Previous Work

Most of known methods of deblurring require prior knowledge uses PSF which a kernel based on the angle and length of the motion.

Original Picture  Blurred, angle=30, length=50  Deblurred Picture
Approach and Method

1. Edge Detection

We used edge detection with high sensitivity. In a motion blurred image, we expected to find large amounts of parallel lines in the direction of movement and very few lines in other directions.
Approach and Method

2. Divide to grids

Since the blur could be local, we can expect part of the scene to be sharp. We divided the image matrix into grids, and looked for motion in each one of them.
The next step was to find parallel lines in the edge map, we used Hough transform for lines and searched for dominant direction.
Approach and Method

3. Hough Transform

Teta=27 →
The angle computed is 153
Results

The result is a matrix that represents the direction of blur detected in all parts, -1 if motion blur was not found. Here are the results as blue arrows.
Results

Run time: 1.42586 sec

Run time: 2.023569 sec
Results

Run time: 3.25279 sec

Run time: 1.71809 sec
Results

Run time: 3.25279 sec

Run time: 2.040075 sec
Results

Run time: 1.44714 sec

Run time: 1.75275 sec
Results

Run time: 4.03007 sec

Run time: 3.293323 sec
Results

Better results can be achieved by different grid sizes, depending on the pictures size, the size of the object in motion and the motion direction change rate.

Division to 36 grids

Division to 64 grids
Results

Run time: 3.293323 sec
Conclusions

Recognition of motion blurred images gives good results, recognition of about 80% in average of the the motion direction in the grids. Few pictures require lower threshold, more sensitive edge detector. The average run time for picture of size 1500X1000 is about 3.6 seconds.

The majority of images with motion blur are recognized, but there is considerable amount of images without blur that are recognized as images with motion blur. Our suggestion is to run an algorithm to identify blurred areas prior to our algorithm, and try to detect motion only in those areas.
Conclusions

When the algorithm successfully finds motions in a grid, the returned direction is a pretty good estimation of the real motion direction in that grid.

Very dark or very bright areas of motion are more difficult to identify and requires lower threshold of edge detecting.

In some pictures the edge detector find false edges at the ends, therefore motion recognition is more likely to fail in those areas and give false result.

Future work: when the direction of movement is known, finding the amount of movement in that direction could help with restoration of images with motion blur.