

# Motion Estimation

## Exercises in Matlab

### I. Difference Metrics

1. Implement a MATLAB function to calculate the Mean Square Error (MSE) and Sum of Absolute Differences (SAD) difference metrics for any given pair of images.

*[Hint: Your function header should look like `function [MSE, SAD] = difference (im1, im2).`]*

2. Using this function, calculate MSE and SAD between the image 'cam0.png' and the images 'cam0\_s05.png', 'cam0\_s10.png', 'cam0\_s25.png', 'cam1.png', 'cam1\_s05.png', 'cam1\_s10.png', and 'cam1\_s25.png'.

3. Normalize the MSE and SAD values and visualize them on the same plot.

*[Hint: Use function `hold` to plot multiple graphs in the same figure.]*

4. Do you notice any differences in outcome of MSE compared to SAD? How can you explain this?

### II. Motion Estimation

1. Using your function in Section I and the provided MATLAB program 'motion.m', calculate and visualize the motion vectors between two consecutive frames 'frame0.bmp' and 'frame1.bmp'. Fill in the missing parts in 'motion.m' and report on the following tasks.

2. Explain your results. How reliable are MSE and SAD measures? Where can you confirm the motion vectors and where it fails? What is the reason?

3. Vary the variables `blocksize` and `searchwindow` as instructed and explain the effect of each variable on the end result.

a) Set `blocksize = 20` and vary `searchwindow` from 10 to 30, with step size of 4.

b) Set `searchwindow = 20` and vary `blocksize` from 10 to 30, with step size of 4.

4. (BONUS) Adjust the visualization of motion vectors, so that only motion vectors around the players are visualized.

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