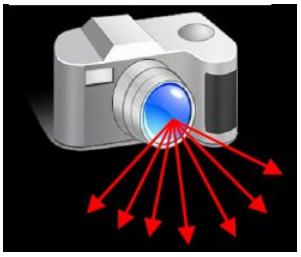
Programming Assignment 1 **[10 points]**

How to build a panorama?

Your friend just got iphone 8 and is showing off the high resolution camera. You decide to go one up on him by building a better panorama than what his phone does. It might help to take a better group selfie. You decide to start building the panorama app using your recently gained compùter vision knowledge.

You start by taking two images with your mobile phone camera. The images are shown below. Your goal is to stitch them using them using simple homography estimation. These images are provided separately with the assignment.



Following are the steps that might help you to build your panorama app. It is easier than you thought. You can use tool of your choice. Matlab commands are provided. Use matlab help to understand the usage of these commands.

1. First try making a panorama using two images only. Than you can repeat the process for more image.
2. You can load the image in matlab using the **imread** command. Use matlab help to figure out how to use the commands mentioned. For example in this case just type **help imread** and press enter.
3. Find out the size of the image by using the **size** command.
4. Now you want to find the corresponding points between two images. For this you need to display images in separate windows. Use the **figure** command to create a window. Next use **imshow** command to display the image.
5. Next select four correspondences between two images. First select four points on figure 1. Use **ginput** command to get these four points.
6. Remember in matlab the coordinate origin is top left corner. X is the column number, Y is the row number.
7. You want to solve this equation **A h = 0**. Matrix **A** is 8x9 and **h** is 9x1. Convert the four point correspondence into **A** using the equation you studied in the class.
8. Next you can take the svd of A using **svd** command. Use the null vector from this svd decomposition to formulate **H** (3x3) from **h** which is 9x1. You can verify your **H** matrix by applying it to the selected corresponding points.
9. Now comes the interesting step. You want to merge the two images. You want to figure out automatically which pixels are novel in image 2 not present in image 1. You can do this by applying the inverse homography to image 2 pixel coordinate. Those pixels that fall outside the boundary of image 1 are new pixels.
10. In order to merge the two images, start by making a big empty matrix. What will be the size of this empty matrix. You can figure this by applying inverse homography to four corners of image 2.
11. Transfer all the pixels from image 2, not present in image 1, to the big empty matrix that you made in the last step.
12. Finally use **interp2** command to interpolate missing values.
13. Remember to use the homogeneous version of all pixel coordinates.
14. **Oral viva will be conducted to judge the originality of assignment.**