

*Assignment #10*

Due date: December 6<sup>th</sup> 11:59PM

5 marks (10% per day late submission)

Instructions: Submit your Python files and images on Gradescope. Please follow the instructions for each file. Test images can be found on Piazza (Ressources). An autograder will be available to ensure that the input/output of your functions complies with the guidelines. Use it to validate your functions. The autograder will only test if your code uses correct input/output. It will not test if your code produces correct results. You can use OpenCV or implement your own solutions. Refrain from displaying images in your functions.

You need to implement the steps of an affine reconstruction using Tomasi-Kanade factorization.

[TKTranslation.py \(1pt\)](#)

```
def TKTranslation( W ):
```

W: The image coordinates of n points in m images. The matrix W is a

2mxn ndarray of the form 
$$\begin{bmatrix} x_1^1 & \dots & x_n^1 \\ y_1^1 & \dots & y_n^1 \\ \vdots & \vdots & \vdots \\ x_1^m & \dots & x_n^m \\ y_1^m & \dots & y_n^m \end{bmatrix}.$$

return: The 2xm ndarray of translations computed by the centroids of points.

[TKCenterData.py \(1pt\)](#)

```
def TKCenterData( W, t ):
```

W: The image coordinates of n points in m images.

t: The translations of the points (from TKTranslation)

return: A matrix of centered data (same size and form as the matrix W)

[TKFactorization.py \(2pt\)](#)

```
def TKFactorization(W):
```

W: The 2mxn matrix of centered data points.

return: M and X, where M is an ndarray (2m)x3 matrix that contains the motion matrices  $[M^1 \dots M^m]$  and X is an ndarray 3xn of the 3D points of the affine reconstruction.

### TKDisplay3D.py (1pt)

```
def TKDisplay3D( X ):
```

X: The 3D (affine) points.

Display the 3D points. You can use the image sequence (posted on Piazza) to obtain your affine reconstruction.

**Reminder:** By submitting your assignment you acknowledge that you have read the JHU Academic Misconduct Policy and that you are the author of 100% of the code submitted. Furthermore, distributing or sharing your assignments (whereas online, with classmates or students that will take this course in future semesters) is not authorized and will be sanctioned with a course grade "F".