Readme file ##########################
Synthetic Dataset for Dense Non-rigid 3D Reconstruction ############
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This zip shares a dataset of synthetic sequences of a deforming face. It consists of the ground truth 3D shapes, the corresponding 2D projections, as well as the 3D reconstruction results of several methods.

Please cite the corresponding publication when using this data:
'Dense Variational Reconstruction of Non-Rigid Surfaces from Monocular Video'
R. Garg, A. Roussos, L. Agapito
IEEE Conference on Computer Vision and Pattern Recognition (CVPR), 2013.

The data is provided without any warranty and to be used for research purposes only.

Note that the mesh data was obtained from the following website:
http://people.csail.mit.edu/sumner/research/deftransfer/data.html

The publication that corresponds to the original data is the following:
'Face transfer with multilinear models',
D. Vlasic, M. Brand, H. Pfister, and J. Popovic ,
ACM Transactions on Graphics 2005 .

Please send bug reports and queries to : l dot agapito at cs dot ucl dot ac dot uk ####
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Files ###################################
This directory contains 3D ground truth and input measurement matrices along with the reconstruction results obtained by different Non-Rigid Structure from Motion methods (for all four synthetic sequences) as reported in Garg etal CVPR 2013. The files for each experiment are stored in the following sub-directories:
Seq1, Seq2, Seq3 and Seq4

Each of these four sub-directories consists of the following files:
1) 'GT.mat': Matlab file with the Ground Truth data. It consists of the following variables:
    i) S_GT : Ground truth shape matrix of size 3FxN where F denotes the number of frames and N denotes the number of pixels in the reference image.
    ii) R_GT: 3Fx3F block-diagonal matrix storing ground truth rotations which were used for 2D projection.
    iii) W2d: 2FxN measurement matrix storing 2D projections of the deformable shapes.
    iv) mask: mask of the size of reference image that stores the neighbourhood structure of quad mesh to be used for TV regularisation (see section "Data Creation" below for more details).
        #NOTE : To obtain the measurement or shape matrix consisting of vertices on the face meshes use following commands:
        > W2d(:,~mask) = [];
        > S_GT(:,~mask) = [];
2) 'MP.mat': file which stores the 3D reconstruction result of Paladini et al IJCV 2012 (see paper for details) . The variables are:
    i) S: Reconstructed shape matrix of dimensions 3FxP. Where P is the total number of vertices on the face (i.e. P = sum(mask(:))).
    ii)R: Estimated 2Fx3F orthographic projection matrices.
3) 'TB.mat' file which stores the results obtained from Akhter et al. PAMI 2011 (see paper for details). The variables are:
    i) S: same as before.
    ii)R: same as before.
4)'ours.mat' file which stores the 3D reconstruction results reported in Garg etal CVPR 2013. The variables are:
    i) S: Reconstructed shape matrix of dimensions 3FxN. Where N is total number of pixels in the reference image.
    #NOTE : To obtain the shape matrix consisting of vertices on the face mesh use following command:
    > S(:,~mask) = [];
    ii)R: Estimated 2Fx3F orthographic projection matrices.
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Functions for Computing Errors #####################
This directory contains the following matlab functions for computing errors:

1) 'compute_error_all_methods.m': script to compute and visualise all the 3D reconstruction errors. It generates Mean RMS as well as RMS 3D errors for our CVPR 2013 method along with the results achieved using Paladini etal and Akhter etal. For more details see comments within this script.

2) 'compute_error.m': stand-alone function that computes the error of a given reconstruction algorithm with respect to ground truth. For details on how to use it, see the comments within the function.
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###########################   Data Creation   ####################################
Please note that the original mesh correspondences had some caveats (oblivious outliers around the mouth).
To account for it about 100 points were eliminated form the original meshes, in the interest of correct evaluation of non rigid structure from motion.
The filtered meshes have been linearly interpolated over time for creating longer sequences.
Synthetic rotations are used to project the data to form a measurement matrix W.
Additionally a 4 connected neighbourhood is defined to facilitate TV regularisation reported in Garg etal.
For this purpose triangles of the original mesh are merged to form a consistent quad mesh.
This quad mesh is stored in 'GT.mat' files (in each folder) as a boolean image template named 'mask'.
All vertices on the mesh are labelled as visible pixels (true) in this image , while the 4 connected image specify the edges (neighbourhood structure) of the quad mesh.
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