Space-Time Steering Kernel Regression for Video

Version 1

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Directory Structure

- Kernel Regression 3D
  - The directory contains the 3-D classic and steering kernel regression for video processing.
- Utilities
  - The directory contains some utility functions.
- Examples
  - The directory contains some video upscaling example, which show how to use the 3-D kernel regression functions.
- MotionToolbox_Hiro
  - The directory contains the motion estimation functions.

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ckr2_regular3D

- Description
  - Second order classic kernel regression in 3-D
- Usage
  - [z, zx1, zx2, zx3] = ckr2_regular3D(y, h, rs, rt, ksize)
- Returns
  - z : the estimated video
  - zx1, zx2, zx3 : the estimated gradients along x1, x2, and x3 directions
- Parameters
  - y : the input video
  - h : the global smoothing parameter
  - rs: the spatial upscaling factor
  - rt : the temporal upscaling factor
  - ksize : the support size of the kernel function

skr2_regular3D

- Description
  - Second order steering kernel regression in 3-D
- Usage
  - [z, zx1, zx2, zx3] = skr2_regular3D(y, h, C, rs, rt, ks, kt)
- Returns
  - z : the estimated video
  - zx1, zx2, zx3 : the estimated gradients along x1, x2, and x3 directions
- Parameters
  - y : the input video
  - h : the global smoothing parameter
  - C : the steering matrices
  - rs: the spatial upscaling factor
  - rt : the temporal upscaling factor
  - ks : the spatial support size of the kernel function
  - kt : the temporal support size of the kernel function

ckr2_motioncomp3D_5frames

- Description
  - Second order classic kernel regression in 3-D with motion compensation
- Usage
  - [z zx1 zx2 zx3] = ckr2_motioncomp3D_5frames(y, mv, rs, h, ksize)
- Returns
  - z : the estimated image
  - zx1, zx2, zx3 : the estimated gradient images along x1, x2, and x3 directions
- Parameters
  - y : the input video
  - mv : motion vectors
  - h : the global smoothing parameter
  - rs: the spatial upscaling factor
  - ksize : the spatial support size of the kernel function
- Note
  - This function estimate a pixel with the local analysis window, ksize x ksize x 5 frames.

skr2_motioncomp3D_5frames

- Description
  - Second order classic kernel regression in 3-D with motion compensation
- Usage
  - [z zx1 zx2 zx3] = skr2_motioncomp3D_5frames(y, mv, rs, h, C, ksize, tshift)
- Returns
  - z : the estimated image
  - zx1, zx2, zx3 : the estimated gradient images along x1, x2, and x3 directions
- Parameters
  - y : the input video
  - mv : motion vectors
  - h : the global smoothing parameter
  - C : the steering matrices
  - rs: the spatial upscaling factor
  - ksize : the spatial support size of the kernel function
  - tshift : the shift parameter which shifts the temporal estimating positions. (1<= tshift < 1)
- Note
  - This function estimate a pixel with the local analysis window, ksize x ksize x 5 frames.

steering3D

- Description
  - the function estimates steering matrices for 3-D Steering kernel regression
- Usage
  - C = steering3D(zx1, zx2, zx3, ws, wt, lambda, alpha, rs, rt)
- Returns
  - C : the steering matrices
- Parameters
  - zx1, zx2, zx3 : the gradients along x1, x2, and x3-axes
  - ws : the spatial window size of the estimation of steering matrices
  - wt : the temporal window size of the estimation of steering matrices
  - lambda : the regularization parameter
  - alpha : the structure sensitivitity
  - rs : the spatial downsampling factor
  - rt : the temporal downsampling factor

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Examples

- 8 examples are available to show how to use the kernel regression functions.
  - “Stefan_3DSKR_motioncomp.m”
    - Space-time upscaling example of Foreman video using the 3-D steering kernel regression with motion compensation.
  - “Foreman_3DSKR_motioncomp.m”
    - Space-time upscaling example of Foreman video using the 3-D steering kernel regression with motion compensation.