

Movement-induced Priors for Deep Stereo

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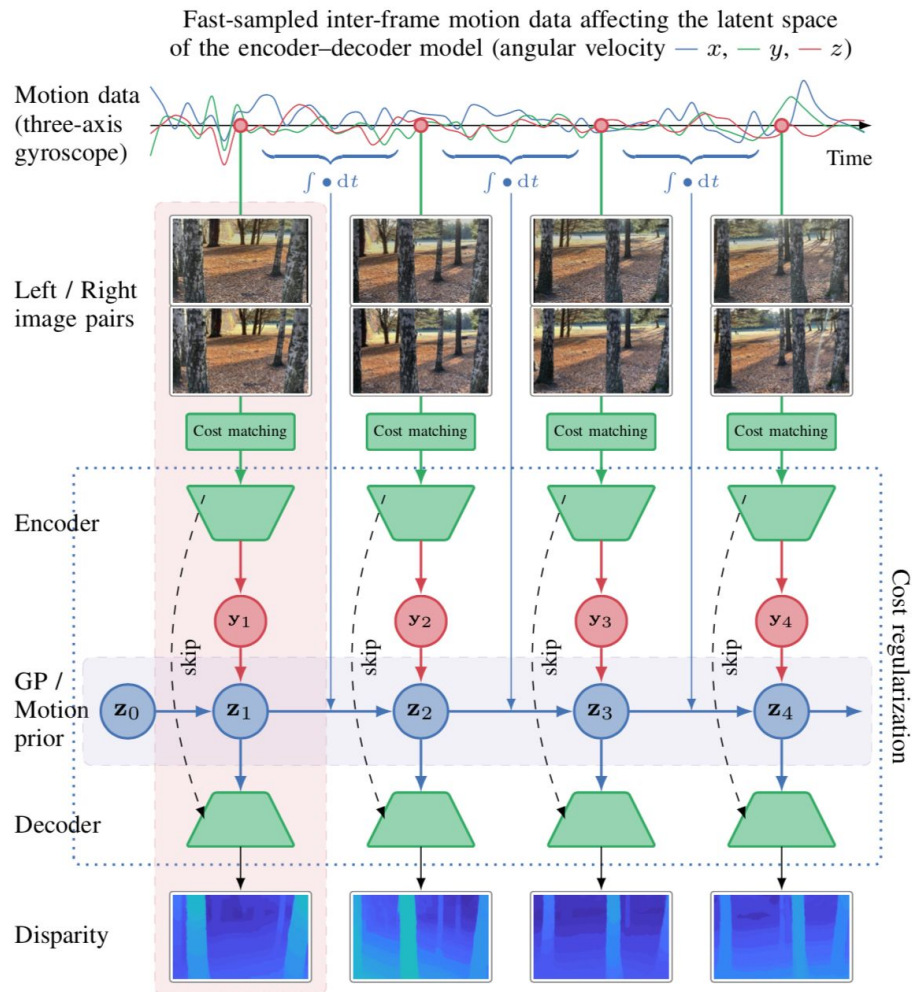
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Motivation

- solving disparity estimation for image pair **sequences**
- **fuse** information between the latent representations
- the latent representations of pairs with similar scenes should be more correlated

=> introduce **movement-induced prior** by framing the problem as a **Gaussian process inference** task.



Existing learning-based methods

obtain a 1D correlation map for each disparity level via inner product of feature vectors

concatenate features to build 4D cost volumes and use 3D convolutions to aggregate cost

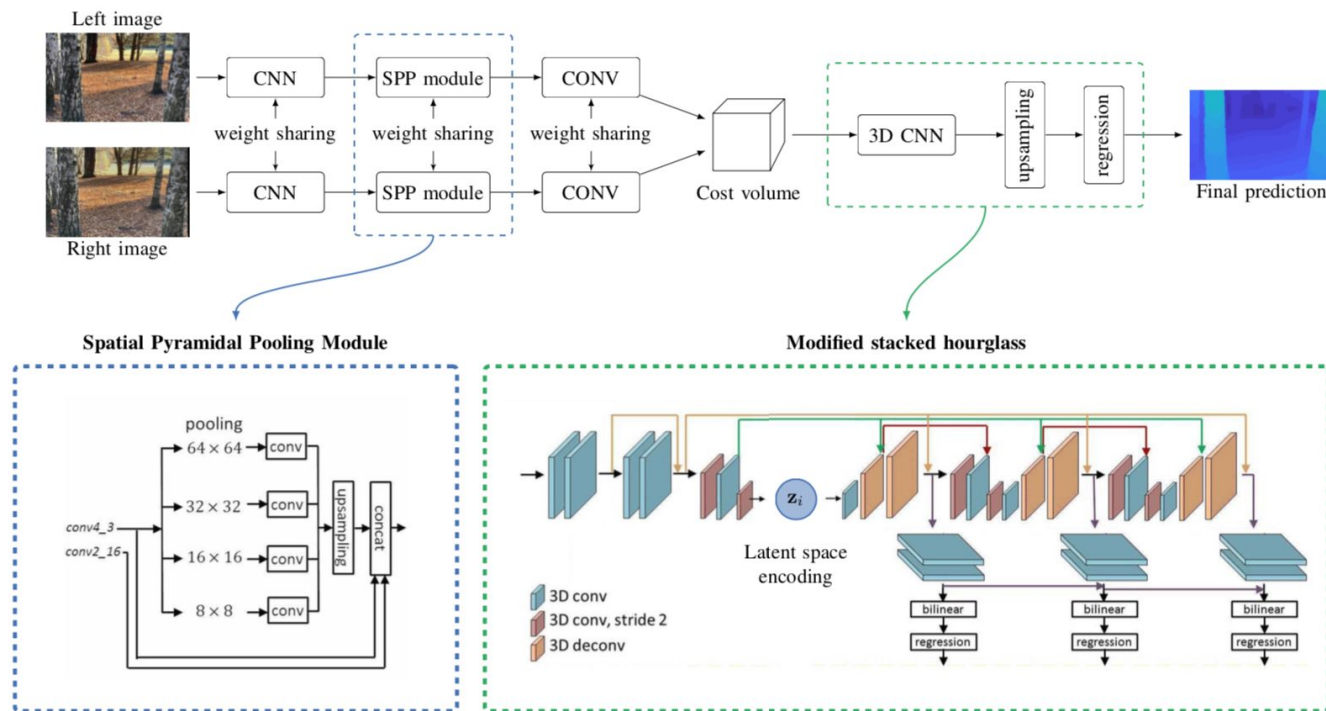
- **DispNetC** [N. Mayer et al., CVPR 16]

- GC-Net [A. Kendall et al., ICCV 17]

- **PSMNet** [J.-R. Chang and Y.-S. Chen, CVPR 2018]

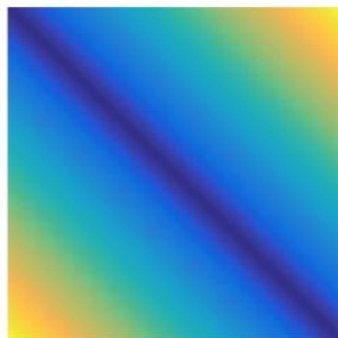
Existing learning-based methods

We modified the auto-encoder architectures in existing methods to enable GP inference

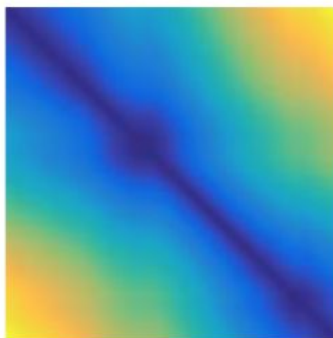


Hierarchy of GP kernels

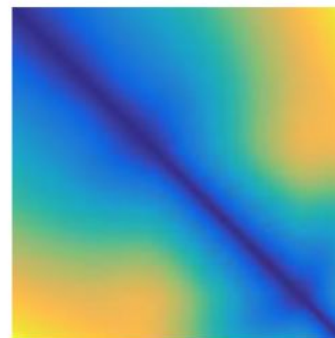
1. a full pose kernel when full rotations and translations are known [Hou et al., ICCV 19]
2. a gyroscope kernel when angular rates of the relative orientation changes are known
3. a time-decay kernel when movement is unknown



(a) D_t

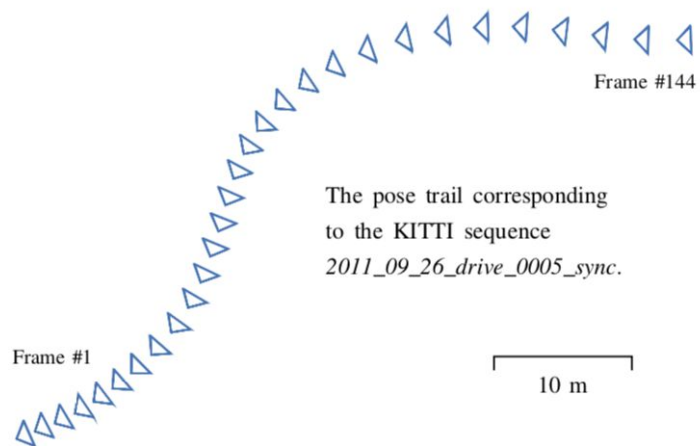


(b) D_{gyro}

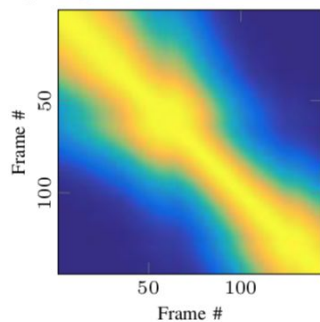


(c) D_{pose}

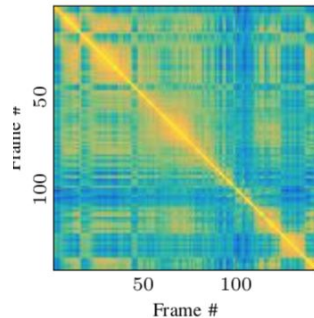
Gyroscope kernel



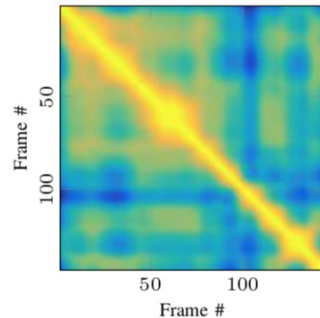
KITTI sequence



Our Markovian
gyro covariance



Latent z correlation
w/o prior



Latent z correlation
w/ prior

Qualitative results



Thank you!