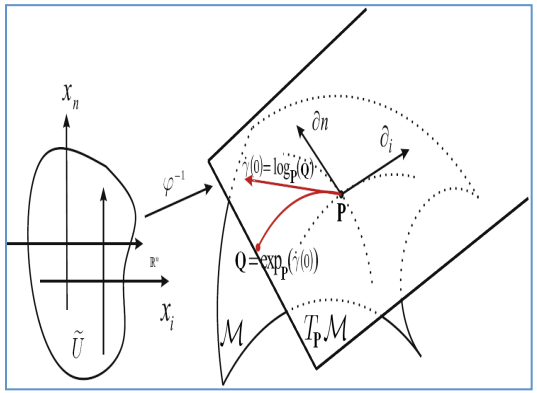
A Nonparametric Riemannian Framework on Tensor Field with Application to Foreground Segmentation

- **Motivation :** Nonparametrically reformulate the existing tensor-based GMM algorithms.

  The idea is to allow the data to show the underlying structure, instead of imposing one.



- **Issue :** applying a nonparametric approach outside Euclidean spaces isn't trivial and requires use of differential geometry to deal with the Riemannian structure and curvature of the manifold.

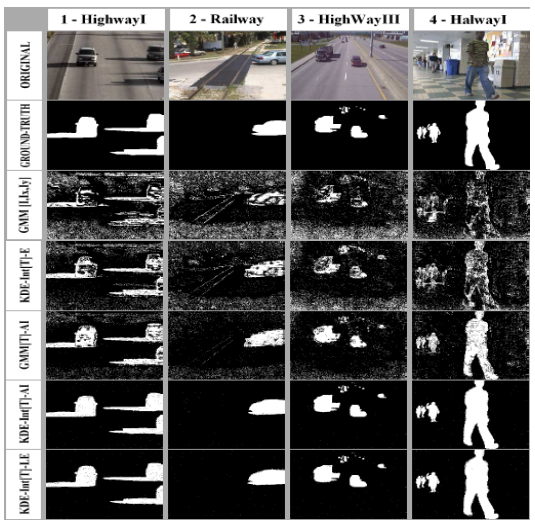
- **Our Approach :** Founded on the mathematically rigorous KDE paradigm on general Riemannian manifolds we define a KDE specifically to operate on the tensor manifold.

$$f_{N,K}(\mathbf{Z}) = \frac{1}{N}\sum_{i=1}^{N}\frac{1}{\theta_{\mathbf{Z}_i}(\mathbf{Z})}\frac{1}{h^n}K\left(\frac{D(\mathbf{Z},\mathbf{Z}_i)}{h}\right)$$

$$\theta_{\mathbf{P}}(\mathbf{Q}) = \frac{\mu_{\exp_{\mathbf{P}}^{*} g}}{\mu_{g_{\mathbf{P}}}}\left(\exp_{\mathbf{P}}^{-1}\mathbf{Q}\right)$$

The tensor manifold is endowed with two well-founded Riemannian metrics :

- **Affine-Invariant**
- **Log-Euclidean**



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Poster ID: 2-71