HAAG Weekly Report Week 4

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Time-Log

- What did you do this week?
  - Setup PyCPD repository for local development
  - Read research paper and ML for Mathematics textbook on EM-Algorithm and application to CPD.
  - Organized meeting with researchers and discussed contribution methods
  - Researched More on Bayesian Statistical Shape Model
- What are you going to do next week
  - Work on implementing the statistical model with the actual scans from the dataset provided by Dr. Porto.
  - Read research Document on Bayesian Extensions and Geodesic Kernels on CPD.
  - Read a new research paper on Statistical models in animal scans.
- Blockers, things you want to flag, problems, etc.
  - No current blockers.

Abstracts

Myronenko and Song, PyCPD: Point Set Registration: Coherent Point Drift Algorithm. IEEE Trans. on Pattern Analysis and Machine Intelligence, 2009.

https://arxiv.org/abs/0905.2635

Point set registration is a key component in many computer vision tasks. The goal of point set registration is to assign correspondences between two sets of points and to recover the transformation that maps one point set to the other. Multiple factors, including an unknown non-rigid spatial transformation, large dimensionality of point set, noise and outliers, make the point set registration a challenging problem. We introduce a probabilistic method, called the Coherent Point Drift (CPD) algorithm, for both rigid and non-rigid point set registration. We consider the alignment of two point sets as a probability density estimation problem. We fit the GMM centroids (representing the first point set) to the data (the second point set) by maximizing the likelihood. We force the GMM centroids to move coherently as a group to preserve the topological structure of the point sets. In the rigid case, we impose the coherence constraint by re-parametrization of GMM centroid locations with rigid parameters and derive a closed form solution of the maximization step of the EM algorithm in arbitrary dimensions. In the non-rigid case, we impose the coherence constraint by regularizing the displacement field and using the variational calculus to derive the optimal transformation. We also introduce a fast algorithm that reduces the method computation complexity to linear. We test the CPD algorithm for both rigid and non-rigid transformations in the presence of noise, outliers and missing points, where CPD shows accurate results and outperforms current state-of-the-art methods.

What did you do and prove it

Links to papers read: https://arxiv.org/abs/0905.2635

Repository url: https://github.com/Nikitos1865/pycpd-Porto/tree/master