Image registration using optimal transport

Internship proposal

Scientific context Image registration [7, 8, 9] is an image processing technique allowing to align two or more images in the same common geometrical space. It has lot of practical applications (image segmentation, motion estimation, image statistics,...) and remains still a very active field in computer vision of biomedical imaging. A problem related to image registration is to find the common space (the template space) that will be adequate for the registration itself or for further processing (e.g. image analysis or image statistics). In order to find this new latent common space, we propose to use Wasserstein barycenter[2] method based on the optimal transportation theory[5]. Optimal transport is an attractive mathematical method that has gained a considerable attention recently due to the theoretical [10] as well as numerical advances [1]. Despite the appealing intuition and computational efficiency, its use in neuroimaging remains as for now quite limited [6, 4, 3].

Objectives The objective of this internship is to present new solutions for the image registration and the template space estimation problems using recent development in optimal transport theory. More specifically, we will use the Wasserstein barycenter approach to derive new scalable methods for image registration.

During the internship, the proposed method will be applied to the registration of biomedical images and more specificaly MR images of the brain.

Keywords image registration, optimal transport, machine learning, biomedical imaging

Skills Strong knowledge in at least one of the following fields is required:

- Image processing (image registration);

- Statistical learning (machine learning);

- Applied mathematics;

- Statistics.

The available code is written in Matlab and Python but other languages can be used. The successful candidate is expected to be autonomous and show strong motivation and interest in multidisciplinary research (image processing and machine learning in a medical context).

Applications Interested applicants are required to send a cover letter, CV and any other relevant documents (reference letter, recent transcripts of marks,...) to: `ievgen.redko@creatis.insa-lyon.fr` and `michael.sdika@creatis.insa-lyon.fr`.

Gratuity $\approx 540 \,€/\text{mois}$.

References

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