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PROPOSITION DE STAGE EN COURS D'ETUDES

Référence : **DTIS-2019-63**
(à rappeler dans toute correspondance)

Lieu : Palaiseau

Département/Dir./Serv. : DTIS/IVA

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DESCRIPTION DU STAGE

Domaine d'étude : Intelligence artificielle et décision, Perception et traitement de l'information

Type de stage ☒ Fin d'études bac+5 ☒ Master 2 ☐ Bac+2 à bac+4

Intitulé : Classification of 3D point clouds by convolutional neural networks

Sujet :

3D data are now the standard for environment perception, and replace images in various usecases: autonomous cars, urban mapping, forensics. They usually come as point clouds (coordinates in the 3D space) with an associated radiometry. With the uprising of low-cost sensors (Kinect, Iphone-X 3D sensor…) and professional devices (laser scanners) point clouds are commonly used as inputs of algorithms for surface reconstruction, semantic segmentation or 3D graphics.

The objective of the internship is to design and develop algorithm for classification of 3D data and semantic segmentation of 3D scenes. It will build on convolutional neural networks such as SnapNet, developed at ONERA/DTIS, which are among the best of the state of the art for urban semantic segmentation (Semantic 3D benchmark http://semantic3d.net , **[Boulch 2017]**) and robotics (NYUv2 and SUNRGBD benchmarks **[Guerry 2017]**).

Especially, the intern will work on two hot topics of 3D classification and machine learning.

- How to process and sample efficiently the 3D information ? Either in 1D (as in PointNet++ **[Qi et al. 2017]**), or in 2D (as in our own SnapNet), or in 3D (by voxels, as in VoxNet **[Maturana & Scherer 2015]**)
- How to include geometric a priori in the convolutional network, to help recognizing 3D shapes and improve classification ? On the contrary of standard geometric approaches such as **[Schnabel 2007]**, this problem will be tackled directly using statistical learning.

The work program will comprise of: study of learning approaches for 3D geometric shape recognition and 3D semantic segmentation; coding (python) and experiments with CNNs using open libraries such as Pytorch or Tensorflow; application to robotics and urban cartography benchmarks.

References:

[Boulch 2017] Boulch, A., Le Saux, B. and Audebert, N., 2017, April. Unstructured point cloud semantic labeling using deep segmentation networks. In Eurographics Workshop on 3D Object Retrieval (Vol. 2).

[Guerry 2017] Guerry J., Boulch. A, Le Saux B., Moras J., Plyer A. and Filliat D., SnapNet-R: Consistent 3D Multi-View Semantic Labeling for Robotics, ICCV Workshop 3D Reconstruction Meets Semantics 2017

[**Qi et al. 2017]** Qi, Charles R and Su, Hao and Mo, Kaichun and Guibas, Leonidas J, PointNet: Deep Learning on Point Sets for 3D Classification and Segmentation, CVPR, 2017.

[Maturana & Scherer 2015] Maturana, D. and Scherer, S., VoxNet: A 3D Convolutional Neural Network for Real-Time Object Recognition, IROS, 2015.

[Schnabel 2017]]Schnabel, R., Wahl, R. and Klein, R., 2007, June. Efficient RANSAC for point-cloud shape detection. In Computer graphics forum (Vol. 26, No. 2, pp. 214-226). Blackwell Publishing Ltd.

Est-il possible d'envisager un travail en binôme ? Non

Méthodes à mettre en oeuvre :

☒ Recherche théorique	☐ Travail de synthèse
☒ Recherche appliquée	☐ Travail de documentation
☐ Recherche expérimentale	☐ Participation à une réalisation

Possibilité de prolongation en thèse : Oui

Durée du stage : Minimum : 4 mois Maximum : 6 mois

Période souhaitée : January - September 2019

PROFIL DU STAGIAIRE

Connaissances et niveau requis :	Ecoles ou établissements souhaités :
Machine Learning, Deep Learning, Image Processing and Algorithmic Geometry.	Grandes Écoles, Master 2 recherche learning / computer vision
Programming experience (python, etc.)	Ms. Eng. (CS, EE, …), M.Sc.