Université Gustave Eiffel

LaSTIG

IGN
INSTITUT NATIONAL DE L'INFORMATION GÉOGRAPHIQUE ET FORESTIÈRE

Thesis Presentation

Point cloud based large-scale place recognition
Application to the prevention against fake news

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Point cloud based large-scale place recognition
Application to the prevention against fake news

Situation : a fact checking units is asked "*Is the video real ?*"

amateur video

True ?

Fake ?

Problems :
-Complex problem
-Done by hand

Point cloud based large-scale place recognition
Application to the prevention against fake news

Fact checking units is asked : "*Is the video real ?*"
→Let's start with : "*Where was the video taken ?*"

amateur video

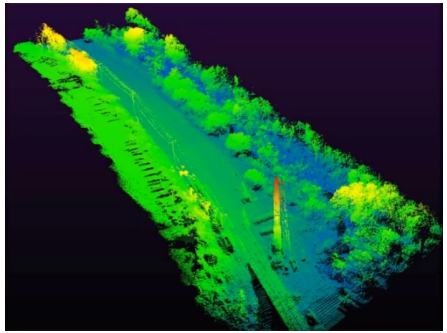
Where ?

Goals:
-Simplify the problem
-Being automated

Large-scale place recognition applications

Scene reconstruction → Place recognition

amateur video



Scene reconstruction

New question :
where is this point cloud ?

Large-scale place recognition applications

3 research topics:

-Single source description
single 3D data source (LiDAR) → to study and improve the robustness of the best approaches

-Multi-source description
extend to the other type of 3d representations (SfM, SLAM, Photogrammetry), a description for each ?
a cross-domain description ?

-Large scale indexing and retrieval
scale up, in terms of research time and robustness of the descriptions in relation to the volume

Single source description

Long term dataset

4 zones:
Downtown, residential, suburban, commercial

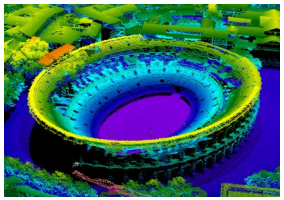
10 trajectories

recorded 8 times, at different lighting conditions

ALITA: A Large-scale Incremental Dataset for Long-term Autonomy (Yin et al, 2022)

We could try alos the Oxford RobotCar dataset (Maddern et al, 2016): same 10 km route 2 times every 2 weeks for 1 year

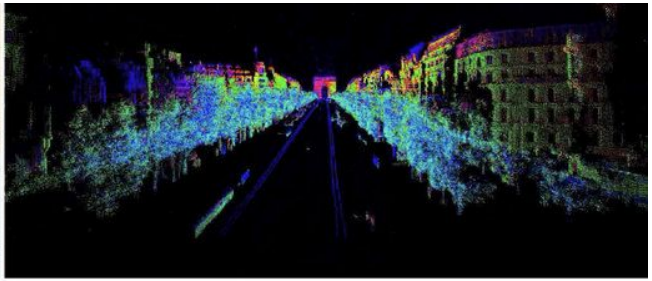
Multi-source description and large scale indexing and retrieval



-LIDAR HD (IGN)

-Create our own TLS dataset

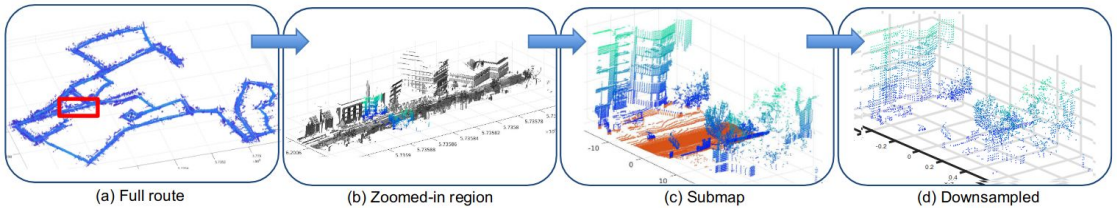
-Test on points cloud extracted from videos



STEREOPOLIS II: (Paparoditis et al, 2022)

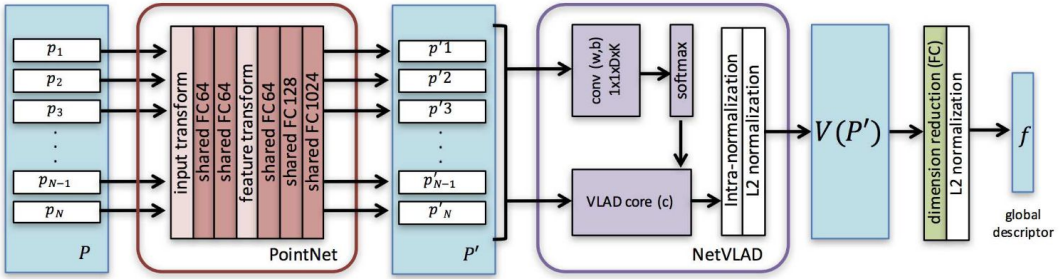
-Mobile land mapping

First method tested : PointNetVlad



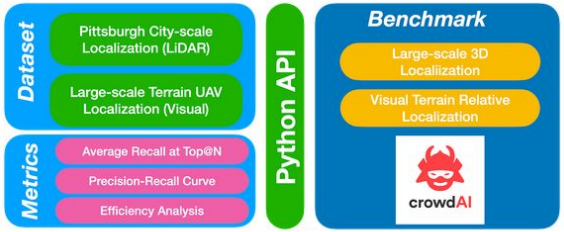
Submap creation PointNetVlad [Uy et al, 2018]

Point cloud as an input
descriptor as an output



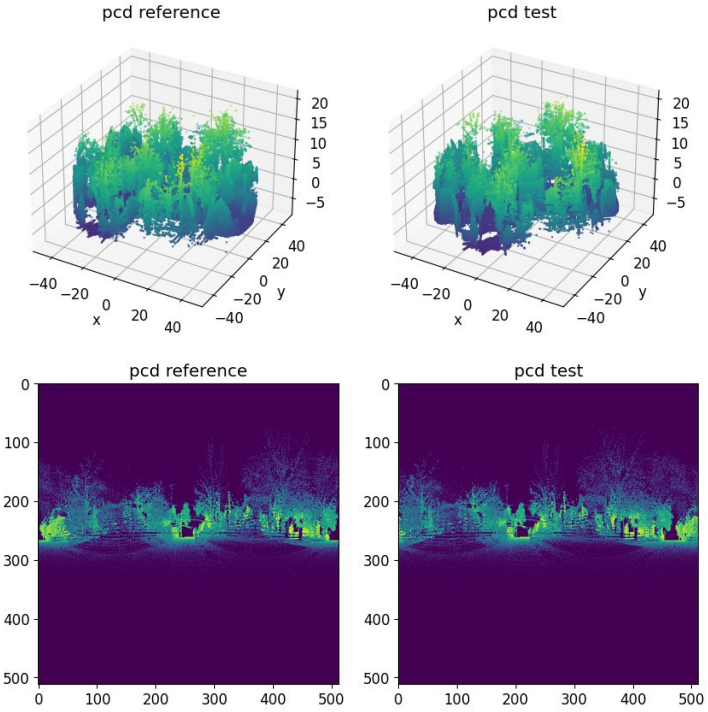
PointNetVlad architecture [Uy et al, 2018]

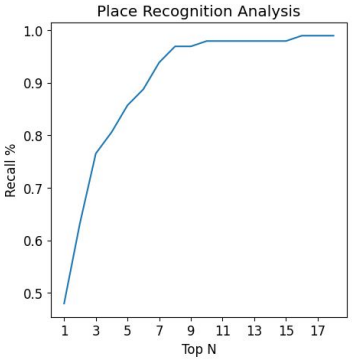
Evaluation



System Architecture of the MetaSLAM SDK

GPR Competition ICRA 2022





Paparoditis, N., Papelard, J. P., Cannelle, B., Devaux, A., Soheilian, B., David, N., & Houzay, E. (2012). Stereopolis II: A multi-purpose and multi-sensor 3D mobile mapping system for street visualisation and 3D metrology. *Revue française de photogrammétrie et de télédétection*, *200*(1), 69-79.

Maddern, W., Pascoe, G., Linegar, C., & Newman, P. (2017). 1 year, 1000 km: The Oxford RobotCar dataset. *The International Journal of Robotics Research*, *36*(1), 3-15.

Yin, P., Zhao, S., Ge, R., Cisneros, I., Fu, R., Zhang, J., ... & Scherer, S. (2022). Alita: A large-scale incremental dataset for long-term autonomy. *arXiv preprint arXiv:2205.10737*.

Uy, M. A., & Lee, G. H. (2018). Pointnetvlad: Deep point cloud based retrieval for large-scale place recognition. In *Proceedings of the IEEE conference on computer vision and pattern recognition* (pp. 4470-4479).