**A propos du centre ou de la direction fonctionnelle**

**Inria Sophia Antipolis - Méditerranée**

The Inria Sophia Antipolis - Méditerranée center counts 34 research teams as well as 8 support departments. The center's staff (about 500 people including 320 Inria employees) is made up of scientists of different nationalities (250 foreigners of 50 nationalities), engineers, technicians and administrative staff. 1/3 of the staff are civil servants, the others are contractual agents. The majority of the center's research teams are located in Sophia Antipolis and Nice in the Alpes-Maritimes. Four teams are located in Montpellier and two teams are hosted in Bologna in Italy and Athens. The center is a founding member of Université Côte d'Azur and partner of the I-site MUSE supported by the University of Montpellier.

**Principales activités**

Automatic city modeling has received an increasing interest during the last decade. Aerial acquisitions with Lidar-scanning or multi-view imagery constitute the best way so far to automatically create 3D models on large-scale urban scenes [12]. Because of high acquisition costs and authorization constraints, aerial acquisitions are, however, restricted to some spotlighted cities in the world. In particular, Geographic Information System (GIS) companies propose catalogs with typically a few hundred cities in the world. Satellite imagery exhibits higher potential with lower costs, a worldwide coverage and a high acquisition frequency. Satellites have however several technical restrictions that prevent GIS practitioners from producing compact and detailed city models and city datasets in an efficient way [5]. Recent works [3,4], illustrated in Fig.1, have demonstrated that buildings can be modeled with a Level Of Detail 1 (LOD1) representation with satellite images at 0.5m resolution by recovering geometry and semantics simultaneously, and exploiting geometric regular regions instead of traditional pixels. An important challenge would now be to reconstruct LOD2 models from the last generation of very high resolution satellite images that describe the piecewise-planar structure of buildings, and iv) the assembling of the geometric shapes to form concise polygonal meshes that conform to the LOD2 CityGML formalism. While the last step has been investigated in previous works [6] and is now mature, the three first steps still require research investigations. In particular, the goal of this study consists in developing robust algorithms for the shape extraction step.

The reconstruction pipeline is traditionally composed of four steps: i) the identification of buildings via image classification, (ii) the extraction of 3D information at the pixel scale with typically the creation of DSM and DTM by stereovision, (iii) the extraction of geometric shapes, typically planes and facades.

The main goal of the PostDoc is to develop efficient, robust and scalable methods for extracting geometric shapes from the last generation of satellite images (at 0.3m resolution). Besides satellite images, input data will also include classification maps that identify the location of buildings and DSMs that bring rough pixel-based estimation of the urban object elevation. The geometric shapes will be first restricted to planes that typically describes well the piecewise-planar geometry of buildings. The goal will be then to detect and identify each roof section of façade component of a building by a plane in the 3D space. Existing shape detection algorithms ([7,8,9]) are typically non-optimal iterative mechanisms that bring no guarantee on the quality of the returned configuration of shapes [10]. Moreover, they are prone to noise points with a low level of noise. Our context is more challenging because 3D points returned by DSMs are highly corrupted by noise. Two main research directions will be investigated.

Shape detection by deep learning. To be robust to highly noisy data, the postdoc will investigate learning algorithms for detecting shapes and their geometric regularities in a more robust manner than the unsupervised and non-optimal existing approaches. Recent work shows basic 2D geometric shapes could captured objects in images efficiently with deep learning architectures operating on continuous parameter space. With more complex 3D shapes such as planes, an important problem to tackle will be to design architectures with reasonable computational complexity. Another issue to address will be to create efficient and relevant training sets from synthetic models, as described by [12]. Last but not least, the proposed architectures will have to consolidate missing data and occlusions by using an efficient multi-scale shape representation.

Shape refinement. Given an initial configuration of planar shapes, the postdoc will explore mechanisms for improving the quality of the configuration. This quality will be measured by an objective function to define that will take into account i) the accuracy of shapes (eg Euclidean distance between inliers and shapes), ii) the completeness (eg ratio of inliers) and the complexity (eg number of shapes). Depending on the form of the objective function, efficient optimization procedures will have to be developed, either in variational or stochastic frameworks.

More info can be found at [https://team.inria.fr/titane/files/2019/11/postdoc_urban-modeling_Luxcarta.pdf](https://team.inria.fr/titane/files/2019/11/postdoc_urban-modeling_Luxcarta.pdf)

**Informations générales**

- **Thème/Domaine**: Vision, perception et interprétation multimedia
- **Ville**: Sophia Antipolis - Méditerranée
- **Date de prise de fonction souhaitée**: 2020-03-01
- **Durée de contrat**: 1 an, 7 mois
- **Date limite pour postuler**: 2020-01-31

**Contacts**

- **Equipe Inria**: TITANE
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**A propos d’Inria**

Inria, l’institut national de recherche dédié aux sciences du numérique, promeut l’excellence scientifique et le transfert pour avoir le plus grand impact. Il emploie 2400 personnes. Ses 200 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3000 scientifiques pour relever les défis des sciences informatiques et mathématiques, souvent à l’interface d’autres disciplines. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 160 start-up. L’institut s’efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l’économie.

**Consignes pour postuler**

**Sécurité défense**

Ce poste est susceptible d’être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L’autorisation d’accès à une zone est délivrée par le chef d’établissement, après avis ministériel favorable, tel que défini dans l’arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l’annulation du contrat.

**Politique de recrutement**

Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.

**Attention**

Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d’autres canaux n’est pas garanti.


Avantages

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of teleworking (after 6 months of employment) and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Rémunération

Gross Salary: 2653 € per month