3iA Côte d'Azur
Interdisciplinary Institute for Artificial Intelligence

Postdoctoral research topic

Title of the proposed topic: AI-based analysis of the tumor extracellular matrix

- **Research axis of the 3IA:** Axis 3 (AI for Computational Biology and Bio-Inspired AI)
- **Supervisor :** Ellen Van Obberghen-Schilling, DR1 Inserm (vanobber@unice.fr)
- Co-supervisors**:** Laure Blanc-Féraud (blancf@i3s.unice.fr); Xavier Descombes (Xavier.Descombes@inria.fr)
- **The laboratory and/or research group:** Institute of Biology Valrose (iBV), Team 25 « Adhesion Signaling and Stromal Reprogramming in the Tumor Microenvironment »

Apply by sending an email directly to the supervisor
The application will include:

- Letter of recommendation of the supervisor indicated above
- Curriculum vitæ including the list of the scientific publications
- Motivation letter
- Letter of recommendation of the PhD thesis supervisor

- **Description of the topic:**

During tumor progression, the physiological extracellular matrix (ECM) undergoes significant changes in composition and topology as well as a global increase in abundance and stiffness. The resulting "pathological" ECM of tumor tissue contributes to carcinoma progression, spread and resistance to therapy. Our research is focused on head and neck cancer for which immunomodulatory therapies are promising, yet resistance rates are high since less than 20% of patients respond. We are specifically interested in exploring architectural features of the tumor ECM environment, together with immune cell signatures, for gaining mechanistic insights into disease progression and identifying predictive biomarkers of immunotherapy response.
Multiparametric imaging techniques, empowered by deep learning-based approaches, provide quantitative information about the phenotypes and spatial distribution of cells in the tumor microenvironment. However, quantitative characterization of *non-cellular* components of tumors, such as the ECM, remains challenging and raises image processing questions that are not yet resolved by standard software. Our previous work on ECM topology based on confocal images of cell-derived ECM has provided a framework for quantitative description and modeling of matrix features associated with disease states. The present project involves quantitative characterization of ECM architecture in *in vitro* models and human tumor tissue using multiplex immunofluorescence imaging, empowered by deep learning approaches.

Biological studies will be carried out in the Institute of Biology Valrose, a leading Research Center of the Université Côte d'Azur (UCA) equipped with state of the art core facilities and a dynamic scientific environment. Computational analyses of tumor tissue will be performed in close collaboration with Laure Blanc-Féraud and Xavier Descombes of the I3S Laboratory (MORPHEME group) and clinical partners.

1. Spenlé C, Loustau T, …Sudaka A, Anjuère F, Van Obberghen-Schilling E*, Orend G* (*co-corresponding authors) Tenascin-C Orchestrates an Immune-Suppressive Tumor Microenvironment in Oral Squamous Cell Carcinoma. Cancer Immunol Res. 2020 Sep;8(9):1122-1138.
2. Efthymiou G, Saint A, Ruff M, Rekad Z, Ciais D and Van Obberghen-Schilling E Shaping Up the Tumor Microenvironment with Cellular Fibronectin. Front Oncol. 2020 Apr 30;10:641.
3. Efthymiou G*, Radwanska A*, Grapa A-I, …Descombes X, Blanc-Feraud L and Van Obberghen-Schilling E. Fibronectin Extra Domains tune cellular responses and confer topographically distinct features to fibril networks. (*equal contribution) Journal of Cell Science (in press)