PhD Project: AI for phenotypic profiling in drug screening by live cell imaging

Keywords: machine learning, computer vision, cell biology, drug discovery
Institutions: Cairn Biosciences and CBIO MINES ParisTech
Location: Paris, France
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Context

A PhD position is open at the Center for Computational Biology (CBIO) of Mines ParisTech, in collaboration with the drug discovery startup Cairn Biosciences, that is developing next-generation therapeutics addressing significant challenges in the treatment of serious diseases, with an initial focus on cancer.

The candidate will hence have the opportunity to work in a startup setting with a small team and fast-pace, as well as in an academic laboratory home to world experts in the field of machine learning applied to biology.

Abstract

Acquired resistance to therapy represents a pressing problem for oncology drug discovery and cancer patients. Cancer cells are poised to evolve resistance to therapy due to their hallmarks of genetic instability and rapid proliferation. With 17 million cancer patients diagnosed/year and 100+ clinically approved targeted oncology therapies, there is a critical need for new drugs to bypass acquired resistance to cancer therapy.

Large scale imaging approaches, such as High Content Screening (HCS) allows to systematically explore many different aspects of cellular phenotypes [2], e.g. cell morphology, protein kinetics and spatial distribution of proteins inside cells.

In this regard, the live cell high-content datasets being generated at Cairn Biosciences offer an exciting opportunity to apply machine learning to unique datasets that we anticipate will yield important insights into the dynamic and adaptive cellular processes that underpin the problem of acquired resistance.

The goal of this PhD is thus to explore different computational strategies to profile the multi-modal cell image time series generated by Cairn's platform, which poses important challenges in terms of automatic analysis at both the individual cell level and the cell population level. Addressing these questions requires the development of novel methods, mainly in image analysis, machine learning and time series analysis.

Furthermore, the dynamic and spatial complexity of the datasets will allow the exploration of new methodologies to study biological phenotypes associated with relevant conditions/treatments.

Candidate profile

- Master in Data Science, Machine Learning, Computer vision, or related field
- Proficiency in at least one relevant programming language (e.g. Python, C++)
- Excellent verbal and written communication in English
- Experience with Deep Neural Networks
- Knowledge or interest in learning about cell biology, microscopy and drug discovery

Partnering Institutions

The **Centre for Computational Biology** (CBIO) is a Research Centre of Mines ParisTech, one of the major engineering schools for applied mathematics in France. Research conducted at CBIO is dedicated to the development of methods and tools in the fields of Machine Learning, Statistics and Computer Vision in order to analyze massive data generated in life sciences and medicine. CBIO researchers work on a broad range of applications, from questions in fundamental life science to precision medicine. CBIO has a partnership with Inserm, the French national institute of health and medical research, and Institut Curie, a major hospital and research center dedicated to cancer. This partnership provides access to the infrastructure and facilities of the Institut Curie and facilitates collaborative projects with other groups at the Institut Curie, as well as data sharing. The laboratory is located in the heart of Paris and therefore benefits from an exceptional scientific and cultural environment.

Cairn Biosciences is a drug discovery startup with headquarters in San Francisco, USA and a branch in Paris. We are developing next-generation therapeutics that address significant challenges in the treatment of serious diseases. Our proprietary approach enables us to interrogate multiple dynamic facets of previously inaccessible, complex biology in live cells. We are poised to fast-track the discovery of a pipeline of drugs for a wide range of indications with an initial focus on cancer. The analytics team of Cairn Biosciences is located at Station F in Paris, one of the biggest startup campuses in the world.

References

[1] Nowell. The clonal evolution of tumor cell populations. *Science* 194, 23–8 (1976).

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[3] Lafarge, M. W., Caicedo, J. C., Carpenter, A. E., Pluim, J. P., Singh, S., & Veta, M. (2019, May). Capturing Single-Cell Phenotypic Variation via Unsupervised Representation Learning. In *International Conference on Medical Imaging with Deep Learning* (pp. 315-325).

[4] Boyd, J. C., Pinheiro, A., Del Nery, E., Reyal, F., & Walter, T. (2020). Domain-invariant features for mechanism of action prediction in a multi-cell-line drug screen. *Bioinformatics* 36.5, 1607-1613.

To apply please send an up-to-date CV, a motivation letter detailing your interests and experiences, and references to Thomas Walter (thomas.walter@mines-paristech.fr) and Amin Fehri (afehri@cairnbio.com).