

AUTOMATIC CEPHALOMETRIC ANALYSIS

R&D MASTER / ENGINEERING INTERNSHIP

PHD CIFRE (INDUSTRIAL PARTNERSHIP) OPPORTUNITY IN CASE OF SUCCESS

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Application deadline: **November 30th, 2018**

Beginning of the internship: **February 4th, 2019**

Duration: **6 months** (longer duration possible condition to an agreement with the University/School)

Financial support: **according to the competencies and the motivation of the candidate**

Locations of the internships: **Lyon, France**

Keywords: Image Classification, Medical Image Analysis, Machine Learning (ML), Deep Learning (DL), Generative Adversarial Networks (GAN), Hidden Markov Model – HMM, Multiple Instance Learning (MIL), Convolutional Neural Networks (CNN), U-net, Graph Theory, TensorFlow, Keras.

Project – OPERATIONAL SYSTEM FOR AUTOMATIC CEPHALOMETRIC ANALYSIS

The project consists of the construction of an efficient and effective operational system for the recognition of anatomical points on a 2D cephalometric radio. This operation is essential for a good preparation of an orthodontist's work. Among the multitude of existing points, we will set the priorities according to the importance and the discriminating aspect of the point, facilitating its automatic detection. Supporting this first detection - which will be done using deep machine learning - Bayesian models and graphs are to be considered to consolidate the reconstruction of the entire layout. If performance requires it, a 3D virtual model could be built and used to make the approach more robust.

Context of the internship:

KITVIEW develops innovative solutions based on image analysis (medical and natural) to continuously improving the ergonomics of its software, offering advanced features to its customers and partners, as well as targeting new markets in France and abroad.

Competencies (selection) requested to reinforce our R&D projects:

- Image Classification, Pattern recognition, Machine Learning (SVM, Random Forest, HMM ...), Deep Learning (CNN, U-net, GAN, MIL - Libraries: TensorFlow...);
- Medical image analysis, conditional probabilities, graph theory;
- Rapid prototyping of ergonomic, modern software interfaces.

Applicant profile:

- University Master or Engineering School student (last year of study) with computer science, image analysis and/or applied mathematics profile;
- Interest, curiosity, learning capability and creativity are qualities we do appreciate;
- Positive spirit, communication skills and ability to work in a team, if necessary;
- Autonomy, dynamism and motivation to advance his/her own part of the project;
- Excellent methodological and hands-on computer programming skills. Programming languages: Python, C ++. Libraries: TensorFlow, Keras, Open CV, CUDA;
- Facility of understanding and manipulating mathematical models.

Expected deliverables:

- Development of software components (data collection, expertise formalization/modeling, study of the state of the art and technology intelligence, design, test, validation);
- Proof of concept in interaction with the client/partner, if the progress of the project allows it;
- Possible publications and patents, with the prior consent of Kitview;
- Internship report (including methods used, results and perspectives) as a consistent and effective user manual of the software/code developed.

Remarks:

- A careful assessment of general, methodological and programming skills will be carried out by e-conference or face-to-face (depending on availability);
- A Non-Disclosure Agreement (NDA) will be signed at the beginning of the internship;
- Weekly regular meetings will be organized within the research department, with synthetic presentations of the last advances, problems encountered, necessary support, as the potential and proposed solutions;
- Periodic meetings will be organized within the company / group, according to the projects' timeline and imperatives;
- In case of satisfactory results, **possibility of a CIFRE PhD recruitment within the company**, in partnership with the CREATIS laboratory. This type of pathway will be favored for future recruitment of our permanent R&D collaborators.

Concerning KITVIEW:

KITVIEW is a young company (2008) specialized in the organization and the communication in private medical sectors, whose needs are: "seeing" to better decide and "showing" to convince. The society has developed the eponymous solution (Kitview), a platform allowing a Medical Doctor to organize, find and present cases of patients previously treated by them. As part of this platform, we develop tools/functionalities, which must be innovative and technologically efficient, in areas such as:

- ✓ Faces automatic indexing, Pattern recognition
- ✓ Data classification, Natural language interfaces, The vocal

KITVIEW in numbers:

- ✓ ORQUAL Group's affiliate (100%), N°1 in France in Orthodontic software.
- ✓ More than 1000 clients.

Turnover:

- ✓ 2016: 2 M€
- ✓ 2017: 3.8 M€

Overall workforce: 36 persons.

National and international development:

France (Pau, Strasbourg, Lyon), USA (Florida), UK (London), Switzerland.

Concerning CREATIS: www.creatis.insa-lyon.fr

CREATIS is a biomedical imaging research laboratory, with about 200 persons, whose main areas of excellence and international influence are linked to two fundamental problems, namely:

- ✓ Identification of major health issues that can be addressed by imaging
- ✓ Identification of theoretical barriers in biomedical imaging related to signal and image processing, modelling and numerical simulation.