UNIVERSITÉ CÔTE D'AZUR

BoostUrCAreer call for PhD projects proposal form

Title of the PhD Project: Action detection for improving the diagnosis of autism

Acronym of the PhD Project: Act4autism

First name, last name, email and affiliation of supervisor 1: **François Brémond**
email: francois.bremond@inria.fr
Position: Research Director, PhD
Affliation: # Inria (Institut National de Recherche en Informatique et en Automatique)
Laboratoire CoBTeK, Université Côte d'Azur

First name, last name, email and affiliation of supervisor 2: **Susanne Thümmler**
email: thummler.s@pediatrie-chulenval-nice.fr
Position: Praticien Hospitalier, MD/PhD
Affiliation : # Hôpitaux Pédiatriques de Nice CHU-Lenval, Centre Ressources Autisme,
Laboratoire CoBTeK, Université Côte d'Azur

1. Excellence

1.1 Quality and credibility of the research project;

Introduction and state-of-the-art:

Autism, or autism spectrum disorders (ASD) is an early, severe and long-lasting neurodevelopmental disorder that begins before the age of three. It is characterized by significant socio-communicative alteration and repetitive and stereotypical restricted behaviours. The prevalence, currently estimated at around 1%, makes autism a real public health problem. The early detection of ASD is a crucial issue because it makes it possible to set up intensive and early appropriate care management when certain developmental processes can still be modified.

Act4autism targets the design of an objective quantification of the atypical behaviours on which the diagnosis of autism is currently based, through the video analysis of the behaviours of children with autism and the comparison with the behaviours of children without autism. In this view, computer vision, and in particular Action Detection, is an effective solution for studying the behaviour of large population of children with autism. It allows capturing, in a non-intrusive and continuous way over time, behavioural patterns. Action detection from live video streams is an important task for monitoring patients, building robots for assisted living and other healthcare applications. Although several approaches, including Deep Convolutional Neural Networks (CNNs), have significantly improved performance on action classification, they still struggle to achieve precise spatio-temporal action localization in untrimmed video streams.

They are two categories of work on autism in the wider computer community: those aiming at diagnosing autism and those seeking to treat it using interactive technologies [20]. In this project we are interested in characterization and therefore in the first category. Among the

many existing works, one typical example whose objectives are closely related to ours, is the work of Anzalone et al. (2018)[26]. In this work, the team of authors has focused on the study of joint attention in child-robot interactions to quantify autistic disorder, with a particular emphasis on the synchrony between people during these interactions. Nevertheless, in this work as in most studies, the aim is to characterize or detect only one or two specific behaviours in children with autism on a short period of time, but rarely to quantify a large number of them and analysing them globally in a continuous manner.

Originality and innovative aspects of the planned research; contribution of the action to advancements within the research field:
Temporal action detection aims at not only recognizing the action category but also detecting the beginning and ending of an action instance. Most temporal action detection frameworks consist of two tasks: action boundary proposition and action classification.

The first one, "action boundary proposal", consists in determining the temporal boundaries of each action instance. Existing work as [10, 14, 13, 8, 6] have low precision on this detection of temporal boundaries. Algorithms meet difficulties for detecting long complex actions (e.g. cooking) compared to detecting simple ones (e.g. waving). Besides, they usually fail to detect actions for which the duration varies significantly, from a couple of seconds to few minutes. In another direction, to obtain high localization accuracy, a large number of window scales and small sliding steps would be needed, which can lead to dramatically increased computational cost. Hence, we lack of an efficient and robust algorithm for localizing the actions.

The second task is "action classification", which is to classify accurately a video segment with an action label. Recently we have designed high performing model [1, 2], which can get more than 90% accuracy on several public datasets such as NTU-RGB+D [9]. However, these models fail to achieve high performance in real life setting datasets. Errors come with handling real life challenges, such as high environment diversity, multi-view settings, low awareness of camera, high duration variation, etc. In addition, long action recognition with composite actions (e.g. making coffee, pour grain and pour water) and fine-grained actions with different objects (e.g. drinking from a cup or from a bottle) are still unsolved tasks. Hence, we are still in need of robust algorithms for action classification in real life settings.
The action detection algorithm that we want to develop will be deployed in real life settings, to detect the activities in real-time of a large population of children with autism and to help analyzing their behaviour.

Specific research objectives:
In this project, we want to go beyond Deep Learning by taking advantage of CNN networks for action classification and by embedding them into a temporal action detection framework for action localization to address the analysis of complex human daily living datasets.

The challenge is to design a method that can process an untrimmed video in both online and offline manner and in doing so, to detect automatically the beginning and end of the targeted actions. A typical system can include two sub-networks, one for generating temporal proposals and one for classifying proposed candidates. The former aims at producing a set of class-agnostic temporal regions that potentially reflect actions of interest, while the latter aims at determining whether each candidate actually corresponds to an action and what class it belongs to. Convolutional Neural Networks (e.g. CNNs, RNNs) will be used in such a system.

The evaluation of the proposed framework and models should be performed on public untrimmed video datasets (for State-of-the-art comparisons) which contain daily activities like AVA [5], PKU-MMD [7], DAHLIA [12] and on autism datasets that will be collected specially for this project.

Application to Autism behaviour:
In addition to the evaluation of the proposed framework with existing daily activities databases, we will focus on its application to the Autism Spectrum Disorders (ADS) thanks to the collaboration with CHU-Lenval Hospital and the Autism Ressources Center of Nice.

Considerations about inter/multidisciplinary and gender aspects:
As described in the previous paragraphs and explained in the next sections, this proposal clearly integrates two scientific domains: clinical/medical and computer science.
Regarding the gender aspects, the targeted application (Autism) is dedicated to both female and male children without distinctions and both will be included in the research work equally. People involved in this PhD proposal (technical work, supervision, clinical studies …) respect the gender diversity and both male and female personal are equally and indifferently involved.

1.2 Interdisciplinary, international and inter-sectoral framework

The diagnosis of ASD is only based on behavioural criteria, with a cruel lack of objective validations and quantitative assessments of these behaviours. The early detection of ASD is crucial as it enables setting up intensive and early appropriate interventions when certain developmental processes can still be modified. Scientific research on ASD suggests the existence of several markers that can be observed during the child's first years of life. They are of a gradual onset, changing the course of development and behavioural patterns between 12 and 36 months. Thus, the identification of behavioural markers reinforces strategies for the detection and diagnosis of ASD in very young children. Many of these studies rely on intensive video observation to analyse the child's natural behaviour and identify possible disorders characterized by abnormalities in social interactions or communication and repetitive behaviour. *These approaches require long time analysis and extensive training of health and early childhood professionals. In addition, diagnosis of ASD includes standardized evaluation tool such as ADOS (Autism Diagnostic Observation Schedule) which are associated with systematic video recordings analysed visually by the clinician.* The Autism Ressources Center of Nice does this type of evaluation several times per week. It already has an important video dataset associated to clinical evaluation.
This work aims at significantly improving such approaches by providing *an objective quantification of the atypical behaviours* on which the diagnosis of autism is based. Act4autism *includes both medical/clinical goals* (e.g. diagnosis assistance and evaluation of therapeutic programs) and *fundamental goals* (e.g. objective description of atypical behaviours). This quantification requires video analysis of the behaviour of people with autism. Act4autism project will address this problem by developing computer vision technologies, including deep learning techniques. Indeed, computer vision is an effective solution for studying the behaviour of a large population of children with autism:

1. it allows to capture behavioural patterns in a non-intrusive and continuous way over time,
2. it has low implementation costs and provides objective and quantified evidence of the impact of the different remediation methods currently used in these children and,
3. it also enables evaluation of the outcomes of (non)-pharmacological treatments.

Act4autism is a clearly interdisciplinary project including life science and computer science. Act4autism brings together researchers in Computer Vision from the Inria STARS and Idiap laboratories and child psychiatrists from the CoBTek laboratory. All these academic teams are world experts in human behaviour analysis. In addition to this collaboration, a part of this project is devoted to the interaction of the academic world with industry through the involvement of a company specialized in video monitoring and video analytics (Nively[1]).

1.3 Quality of the supervision and of the integration in the team/institution

François Bremond (PhD, Research Director) has successfully supervised 20 PhD students in Computer Vision and Machine Learning. Most of the subjects in the related PhD theses were in the domain of activity monitoring and many for healthcare applications. See the PhD list here[2]. He is also the co-director of the CoBTek team from UCA on the study of behaviour disorders.

Susanne Thümmler (MD/PhD) is specialized in translational child and adolescent psychiatry as well neurodevelopmental disorders. She coordinates the Neurodevelopmental Research Group of CoBTek laboratory and has successfully contributed to the supervision of the five PhD students of the Child Psychiatry group of CoBTek lab. She was nominated as Associate Professor (MCU-PH) in Child Psychiatry at the Medical Faulty of Université Côte d'Azur in September 2019.

Inria (through the STARS team) offers an international recognized environment in behaviour monitoring research and has all the needed infrastructures for deep learning and artificial intelligence base research.

CoBTek is specialized in the development of technology-based environments in all fields of psychiatry including all ages from pediatric to elderly populations.

The Autism Ressources Center (CRA) of CHU-Lenval Children's Hospitals of Nice has a long experience in research within the context of neurodevelopmental disorders such as ASD.

2. Impact

2.1 Potential impact on the fellow career in terms of employability within and outside academia

Through this PhD thesis, the candidate will have both opportunities for employability within academia and within the industrial sector.
Within academia, the subject of the PhD proposal entails fundamental research challenges in Artificial Intelligence, giving the opportunity to the PhD student to propose new methods and paradigms adapted to activity recognition in complex environments. Indeed, the candidate has to provide significant efforts to solve the problems related to recognising diverse autistic children behaviours. State-of-the-art methods have to be adapted to this context and new algorithms have to be developed to recognise and classify the different behaviours. Working on such challenging problem, gives the opportunity to publish papers in highly-recognised conferences (e.g. CVPR) and journals (e.g. PAMI). This could open the path for the PhD candidate to follow an academic career within universities or institutions to continue research in the field of activity recognition applied to healthcare in general.

[1] http://www.nively.com/en/
[2] http://www-sop.inria.fr/members/Francois.Bremond/topicsText/supervision.html

The technical challenges, which will be faced by the student during his PhD are mainly related to implementing deep learning algorithms for activity recognition, designing novel architectures, adapting existing technical solutions to the context of autistic children behaviours. Addressing these challenges will build the technical background of the candidate, and will give him the expertise to work in more applied research and on many industrial applications. Depending on the fellow's professional aspirations, the industrial sector is wild open for him.
From the point of view of opportunities, either in academia or in the industrial sector, computer vision and deep learning in general are permanent and non-ending R&D topics, which opens many career opportunities. The healthcare scope of this PhD proposal gives another interesting dimension for possible enrolment within healthcare companies.
Nively[3] (a SME in the PACA region, developing video based monitoring systems applied for healthcare including children with autism) is highly interested in the PhD proposal work. Nively has expressed its interest in being part of the PhD work by mentoring the student, in order to sponsor him for a potential industrial career. A technology transfer of the outcomes of the PhD work to Nively is highly envisaged.

2.2 - Relevance to the smart specialisation strategy of the Region and to the UCA structuring programmes

This PhD proposal aims at addressing a healthcare application, mainly children affected by autism. UCA structuring programs includes:

- The emergence of transdisciplinary: the current PhD proposal aims at solving a complex problem from the perspective of specialists from different disciplines: clinical/medical and computer science.
- The support of the Initiative of Excellence program: the PhD fellow will participate to the different relevant programs organised by UCA (summer school, dissemination activities, education and outreach), such as Big@UCA.
- The organization of transdisciplinary programs: the PhD fellow will be part of the transdisciplinary programs of UCA, which concerns healthcare, cognitive systems and data science, such as MNC3.

The current PhD proposal can be integrated in the following core programs of UCA:

- *Environment, health, citizens*: the proposal addresses a healthcare problem related to autism in children.
- *Cognitive Systems, Normality and Pathology of the Human Brain, and Computational Neuroscience*: autism is a developmental disorder characterized by difficulties with social interaction and communication and by restricted and repetitive behaviour. The current PhD proposal addresses this pathology.
- Data sciences: the research work during this PhD will rely on data analysis, artificial intelligence and deep learning.

This project contributes to the dynamics of the PACA region through its different partners: academic (Inria), clinical (Lenval-CRA) and industrial (Nively), in a perspective of designing a digital solution for healthcare, one of the privileged research topics in the region.

2.3 Potential for social and/or economic transfer to the non-academic sector (if applicable)

Act4autism represents a major innovation and technological advance. To our knowledge, a similar system has never been developed to date. In the context of early diagnosis of ASD, this type of tool is undeniably necessary, *as diagnostic criteria used so far to distinguish the*

[3] http://www.nively.com/en/

different forms of ASD are not sufficiently reproducible and objective.
Act4autism aims to propose a global tool combining computer vision based approaches to provide an objective quantification of autistic atypical behaviours. This is of crucial importance since today 1% of children worldwide suffer from autism disorders: in the context of early diagnosis of ASDs, this type of tool is necessary since diagnostic criteria used so far to distinguish the different forms of ASDs are not sufficiently reproducible and objective. Such a tool will improve the therapy efficiency and, by performing an automatic characterization of the diagnostic behavioural criteria of ASD, would enable health professionals to spend more time for the clinical part of the overall interpretation of the data. From a more global point of view, the platform developed within the framework of this project will provide the various research laboratories in the human and life sciences with realistic and unbiased working bases, and serve as a test and validation environment for various behavioural studies. Indeed, the possibility of acquiring large quantities of rich and exhaustive data on human activity in real conditions also opens the way for numerous behavioural analysis studies. By allowing a permanent and non-intrusive analysis on a specific site, the developed solution will enable to process large quantities of unbiased information by involving a large number of different individuals. This richness and diversity will be important to perform robust modelling of behaviour, and possibly to highlight statistical phenomena that are not perceptible on small samples. This platform will also contribute to computer vision research activities: the development of algorithms for estimating the pose of individuals in uncontrolled natural conditions opens the way to many fields of application (home automation, behavioural marketing, security, virtual interfaces, etc.).

3. Implementation

3.1 Coherence of the work plan, feasibility

As presented in the state-of-the-art at the beginning of the current document, activity recognition is widely addressed in literature and significant advances during these last years have allowed building algorithms, methods and paradigms, which allow now recognising several classes of activities in human behaviour. Although this field remains challenging because of the enormous quantity of information to process, artificial intelligence and deep learning techniques have made important breakthroughs. A drawback is that such techniques need in principle a big amount of data to "learn" and to provide accurate models for classifying the different behaviours according to the needs of the medical experts. To address this issue, the project plans are the following: i) the PhD follow will work in close collaboration with the doctors and the clinicians in order to collect the required data with autistic children within the Autism Ressources Center (CRA); ii) to adopt a multi-task approach to leverage multiple data sources (with different levels of annotation) related to activity recognition; iii) to investigate domain adaptation approaches (from general activity recognition to autistic behaviour recognition), relying on adaptation of pre-trained networks, adversarial adaptation, or unsupervised domain adaptation.

The PhD follow will spend (between the second and the third year) 6 months within the Perception and Activity Understanding Group[4] at the Idiap research institute which has academic affiliations with the Ecole Polytechnique Fédérale de Lausanne in Switzerland, under the supervision of Dr. Jean-Marc Odobez. This Group will bring to the PhD fellow and to the project its expertise in computer vision, deep learning and person behaviour and non-verbal behaviour analysis. In particular, the group has a well-recognized expertise in gaze sensing

[4] https://www.idiap.ch/en/scientific-research/perception-and-activity-understanding

and analytics from non-intrusive video sensors, which is very valuable given the importance of that cue for autism analysis.

The PhD thesis will run on three years and half as follow:

First year:

- Study the limitations of existing activity recognition and temporal detection algorithms.
- Write the clinical research protocol and obtain ethical authorizations fitting the needs of the clinical partners. Propose an original algorithm that addresses current limitations on inference: using pre-trained networks and conducting domain adaptation techniques (fine tuning, multi-task learning). Evaluate the proposed algorithm on benchmarking datasets (e.g. clinical video data collected during standard evaluations).
- Write a first paper.

Second year:

- Investigation of feasibility/appropriateness of the framework (the proposed original algorithm) in practical situations.
- Collection of videos of autistic children and the control group according to the predefined clinical research protocol. Propose an algorithm to address model-learning task in semi-supervised settings.
- Write a second paper.

Third and half year:

- Optimize proposed algorithm for real-world scenarios.
- Write one or two other papers (computer vision and medical).
- Write PhD Manuscript and defend the thesis.

3.2 Involvement and guidance abilities of the supervisors

Action Detection is a major research theme for the Stars team and for F. Bremond. Among its many contributions in human activity recognition, Inria STARS has proposed an approach combining real-time people detection [11], 3D skeleton extraction, tracking of people [22], action recognition [21] and semantic recognition of complex activities based on a language and using an ontology of video events that is summarized in [23]. For the past ten years, we have been working in close partnership with specialists in the medical field. The application results of our approach applied to the recognition of older people's behaviour is described in [24]. Moreover, STARS has already achieved the best state of the art performance on most important international benchmarks (CAD60, CAD120, MSRDailyActivity3D, NTU RGB-D, Northwestern-UCLA Multiview Action 3D) [6, 2, 3] for the recognition of everyday life actions. This was done by combining:

- the person's 2D or 3D skeleton (i.e., posture),
- a recurrent LSTM network for the dynamics of gestures (in order to focus also the system attention on most important body parts) and,
- the extraction of patterns around skeletal articulations and meaningful body parts using 3D ConvNet (Convolutional Network), allowing to characterize the objects with which the person interacts.

Several problems remain open to process video streams in a real application. Detecting the beginning and end of an action in a real-time online video stream remains an open problem in the scientific community [Negin-18]. We plan to address them by using deep learning techniques and the notions of "focus of attention" and "actionness" by extracting only the discriminative portions of the image corresponding to the action and by measuring the amount of movement relative to the actions of interest envisaged. To allow independent action

recognition from the camera's point of view, we will also consider work on extracting a person's 3D human skeleton from a single 2D image [25].
About 400 children with Autism Spectrum Disorders are evaluated every year in CHU-Lenval Children's Hospital, where S. Thummler is one of the leading researchers. The Autism Ressources Centre, caregivers and day hospitals are specialized in the treatment and follow-up of these children, thus facilitating the clinical formation and support of the PhD student as well as the implementation of the research protocol in day clinics or in home settings. The clinical research team is specialized in the implementation of information technology (IT) in health settings and especially in autism disorders (CoBTek lab) [16, 17, 18, 19].
Nively, through its personnel (CEO, CTO and R&D engineers) will monitor and participate to the PhD work in order to ensure that industrial applications of the research results are possible.

3.3 Involved means and support from the laboratory (equipment mainly)

To support this work, we have a full team of researchers specialized in human behaviours [15, 11, 3, 2], from experts in activity recognition, people detection and tracking, machine learning, up to medical doctors specialized in behavioural disorders. The STARS team has been working on video analytics since 1994. The "SUP" ("Scene Understanding Platform") Platform developed in STARS, detects mobile objects, tracks their trajectory and recognizes related behaviours predefined by experts. This platform contains several techniques for the detection of people and the recognition of human postures and gestures of people using conventional cameras. Through the Autism Ressources Center and the University Department of Child and Adolescent Psychiatry of Children's Hospitals of Nice CHU-Lenval, we have access to large cohorts of patients and can collect video datasets, dedicated to behavioural disorders, such as the ones induced by autism. We have also large storage resources and a hefty GPU farm, from which 28 GPU nodes are dedicated to STARS team.

4. Ethics; detail any ethical challenges as well as measure to address them (no page limit)

The University Department of Child and Adolescent Psychiatry of CHU-Lenval Children's Hospitals and CoBTek team have a long experience in the elaboration of clinical studies for ASD and neurodevelopmental disorders. The present PhD thesis will include a clinical research protocol for the registration of 30 children with ASD and 30 children without neurodevelopmental disorders (control group). Submission of the project to the Ethics Committee, insurance costs for the inclusion of study participants and authorizations of CNIL will be accompanied by CHU Children's Hospitals and CoBTek laboratory. A specific consent form (validated by the ethics committee) upon enrolment in the clinical study will be signed by the legal guardians and the children. In addition, videos recorded during standard clinical evaluation procedures will be analysed. Authorizations for the use of clinical assessment data for research are obtained from patients and their legal guardians before standard clinical evaluation by the Autism Ressources Center. This form asks the parents whether they agree to authorise the use of videos at three levels: by the healthcare professionals of the CRA, by the training personnel and by researchers. The research protocol will be validated by the Ethical Committee of Université Côte d'Azur.

A template of the standard authorization of the use of clinical video data for research purposes is included at the end of the present proposal.

To compensate for a possible lack of data (especially for machine learning, such as CNN), we plan to use the hundreds of videos already acquired by CoBTek on Behaviour Disorders and for which we already have a license to operate process. Although less dedicated to autism,

these data can be used to bootstrap the main CNN models. Robust algorithms [25] will be used to position articulated models on the people on the scene, to extract useful information for the activity recognition algorithms.

5. Short CV

Supervisor 1 (INRIA): François BREMOND

Main Positions:

- Research Director at INRIA (class one)
- Head of Research Team STARS: on Video Analytics (25 scientists, including PhD students)
- Address: INRIA, 2004 Route des Lucioles, 06902 Sophia Antipolis, France +33 492 38 76 59
- Web Site: http://www-sop.inria.fr/members/Francois.Bremond/

Other Positions:

- 2012-: Co-Director of the CoBTeK team From Nice University: Cognitive Behavior Technology
- 2010-: Head of PULSAR/STARS team at INRIA Sophia-Antipolis on Activity Recognition
- 2000-2009: Researcher at ORION team at INRIA Sophia-Antipolis on Video Understanding
- 1997-2000: Post-Doctoral position at University of Southern California (USC), L.A. - USA
- 1993-1997: PhD student at INRIA Sophia-Antipolis

Education:

- 1993-1997: PhD thesis at the University of Nice, INRIA Sophia-Antipolis, France
- 1989-1992 : Master in Computer Engineering at École Normale Supérieure de Lyon

Publications:

- Author and co-author of 220+ archived scientific publications, author of 10 book chapters.
- Citations: 6 100+,
- h-index: 41: https://scholar.google.com/citations?user=h-oGBzsAAAAJ&hl=fr

Student supervision:

- (co-) Supervised 20+ PhD students (1998 - 2018)

Transfer and valorization:

- General Chair of conference IPAS'18
- Chair of conferences AVSS'09, AVSS'13, AVSS'14, ACM Multimedia'16, ICIAP'17, AVSS'19
- Co-founder of 3 start-up linked to video understanding (Keeneo, NeoSensys, Ekinnox)
- Scientific consultant for several companies
- Technological transfer through collaborative projects: in Video Analytics, Video Understanding, Activity Monitoring, Cognitive Vision, Deep Learning and Control of Vision Software (40 R&D projects, 1 DARPA project and 12 industrial contracts)

http://www-sop.inria.fr/members/Francois.Bremond/topicsText/researchProjects.html

Publications (selection):

- C. Crispim-Junior, K. Avgerinakis, V. Buso, G. Meditskos, A. Briassouli, J. Benois-Pineau, Y. Kompatsiaris and F. Bremond. Semantic Event Fusion of Different Visual Modality Concepts for Activity Recognition, Transactions on Pattern Analysis and Machine Intelligence - PAMI 2016.
- C. Crispim-Junior, A. Gomez-Uria, C. Strumia, M. Kopersky, A. Konig, F. Negin, S. Cosar, A.T. Nghiem, G. Charpiat, F. Bremond and P. Chau. Online recognition of daily activities by color-depth sensing and knowledge models, Sensors 17, MDPI, 17 (7), p. 1-15, 7, June 2017.
- F. Negin, P. Rodriguez, M. Koperski, A. Kerboua, J. Gonzalez, J. Bourgeois, E. Chapoulie, P. Robert and F. Bremond. PRAXIS: Towards Automatic Cognitive Assessment Using Gesture Recognition, in the Expert Systems With Applications journal, Volume 106, Pages 21-35, 15 September 2018.
- S. Das, A. Chaudhary, F. Bremond and M. Thonnat. Where to Focus on for Human Action Recognition? In Proceedings of the IEEE Winter Conference on Applications of Computer Vision, WACV 2019, Waikoloa Village, Hawaii, January 7-11, 2019.
- P. Bilinski and F. Bremond. Video Covariance Matrix Logarithm for Human Action Recognition in Videos. The International Joint Conference on Artificial Intelligence, IJCAI 2015, Buenos Aires, Argentina from July 25th to July 31st, 2015.

Complete list: *http://www-sop.inria.fr/members/Francois.Bremond/topicsText/myPublications.html*

UNIVERSITÉ CÔTE D'AZUR

Supervisor 2 (CoBTek, CHU-Lenval Children's Hospitals): Susanne THÜMMLER

Current Positions:

- Hospital Practitioner (PH), University Department of Child and Adolescent Psychiatry (Pr. Askenazy), Autism Ressources Center, CHU-Lenval, Nice
- Coordination of the Clinical Research Group « Neurodevelopment and Child and Adolescent Psychiatry », Laboratory CoBTek, Université Côte d'Azur (Pr. Robert)

Education:

- 2001 : Medical Degree (*Staats-examen*), University of Leipzig, Germany
- 2003 : PhD (Neurosciences), University of Leipzig, Germany
- 2010: Qualification in Pediatric
- 2016: Diploma (DESC) in Child and Adolescent Psychiatry

Research Experiences:

- 1997 – 2003 : PhD «Electrophysiological studies in prefrontal rodent cortex », Institute of Pharmacology and Toxicology, Leipzig, Germany
- 1998 – 1999 : Department of Pharmacology, University of Denver, USA
- 2004 – 2007: Post-Doc « The implication of K2P Channels in the central nervous system », Institut de Pharmacologie Moléculaire et Cellulaire (IPMC, Pr. Lazdunski), Sophia-Antipolis
- 2004 : Summer School of Neurobiology, INMED, Marseille

2012 – 2019: Research Group « Neurodevelopment » (Pr. Askenazy), Laboratory CoBTek (Pr. Robert) EA7276, Université Côte d'Azur

- 2019 : CNU (MCU-PH)

Fellowships:

- 1996 – 2001: Student fellowship, Friedrich Naumann Foundation, Germany
- 2004: Price PhD «Carl Zeise», University of Leipzig, Germany
- 2004 – 2006: Post-doctoral fellowship DFG (Deutsche Forschungs- gemeinschaft), Germany
- 2006 – 2007 : Post-doctoral fellowship FRM (Fondation pour la Recherche Médicale), France

Student supervision:

- Participated in Supervision of 5 PhD students
- Supervision of 7 MD thesis students
- Participation and Supervision of 5 Master 2 students

Valorization:

- 32 peer-reviewed articles
- 19 oral interventions or posters in 2016-18
- National coordination of the French translation of diagnostic tools in child psychiatry (K-SADS-PL, DIPA DSM-5)
- SIGAPS : 291, Indice h : 11, SIAPS : 444
- Funding : CD06 2017 (74k€), AOI 2016 (15k€), participation CSI 2015 (5k€), CG06 2014 (10k€), ANSM 2016 (14k€)

Main Publications:

- Fernandez A, … Thümmler S (2018) Exploration and characterization of the phenotypic and genetic profiles of patients with early onset schizophrenia associated with autism spectrum disorder and their first-degree relatives: a French multicenter case series study protocol (GenAuDiss). *BMJ Open,* e023330.
- Thümmler S, et al. (2018). Pharmacoresistant Severe Mental Health Disorders in Children and Adolescents: Functional Abnormalities of Cytochrome P450 2D6. *Front Psychiatry* 9:2.
- Serret S, … Thümmler S, … (2017) Teaching Literacy Skills to French Minimally Verbal School-Aged Children with Autism Spectrum Disorders with the Serious Game SEMA-TIC: An Exploratory Study. *Front Psychol* 8:1523.

- Lemmonier E, …, Thümmler S, ... (2017) Effects of the diuretic bumetanide on neurobehavioral function in children and adolescents with Autism Spectrum Disorders. *Transl Psychiatry*, 7:e1056.
- Gros A, … Thümmler S, ... (2016) Recommendations for the use of ICT in elderly populations with affective disorders. *Front in Aging Neurosci,* 8:269.
- Menard M, Thümmler S, … (2016) Incidence of adverse events in antipsychotic-naïve children and adolescents treated with antipsychotic drugs: a French multicenter naturalistic study protocol (ETAPE). *BMJ Open, 6:e011020.*
- Serret S, Thümmler S, … (2015) Lithium as a rescue therapy for regression and catatonia features in two SHANK3 patients with autism spectrum disorder. *BMC Psychiatry,* 15:107.
- Thümmler S, et al. (2006) AKAP150, a switch to convert mechano-, pH- and arachidonic acid-sensitive TREK K+ channels into open leak channels. *EMBO J,* 25: 5864-72.
- Heurteaux C, … Thümmler S, … (2006) Deletion of TREK-1, a background potassium channel, results in a depression-resistant phenotype. *Nat Neurosci,* 9:1134-41.
- Thümmler S and Dunwiddie TV (2000) Adenosine receptor antagonists induce persistent bursting in the rat hippocampal CA3 region via a NMDA receptor-dependent mechanism. *J Neurophysiol,* 83:1787-1795.

6. Include a signed letter from an international collaborator stating he/she is ready to host the PhD for a 6-mont secondment.

A letter from Dr. Jean-Marc Odobez, director of the Perception and Activity Understanding Group at the Idiap research institute, and Maître d'Enseignement et de Recherche (MER) at the Ecole Polytechnique Fédérale de Lausanne in Switzerland, is included.

References

[1] J. Carreira and A. Zisserman. Quo vadis, action recognition? A new model and the kinetics dataset. In 2017 IEEE Conference on Computer Vision and Pattern Recognition (CVPR), pages 4724–4733. IEEE, 2017.

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Martigny, 7th of March 2019

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Obj: Support Letter for the Act4Autism project

To whom it may concern,

This letter is to fully support the application of the COFUND 2019 project (BoostUrCAreer call for PhD projects proposal) **Act4autism,** submitted by François Brémond, research scientist and head of the STARS team at INRIA Sophia-Antipolis, and Suzanne Thummler from Hôpitaux Pédiatriques Nice CHU-Lenval, with the corresponding title:

"**Action detection for improving the diagnosis of autism**"

I also hereby confirm that the Perception and Activity Understanding group which i am leading at the Idiap Research Institute in Switzerland will participate in this project and will bring its know how in computer vision, deep learning and person behavior and non-verbal behavior analysis.

In particular, the group has a well recognized expertise in gaze sensing and analytics from non intrusive remote sensors which is very valuable given the importance of that cue for autism analysis. It is complementary to the principal investigators' expertise and will open good opportunities for collaboration.

Finally, the Idiap research institute confirms that it is ready to host the PhD for a 6-month secondment in the Perception and Activity Understanding group as part of his project participation.

I will be happy to provide any additional information that would be needed.

Sincerely yours,

Jean-Marc Odobez
Head of the Perception and Activity Understanding Group
Idiap Research Institute & Ecole Polytechnique Fédérale de Lausanne (EPFL)

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INFORMATION LEGALE

L'Hôpital LENVAL dispose d'un ordinateur destiné à gérer plus facilement le fichier de ses patients et à réaliser, le cas échéant, des travaux statistiques, ceci dans le strict respect du secret médical.
Certains renseignements vous concernant, recueillis au cours de votre consultation ou hospitalisation pourront faire l'objet d'un enregistrement informatique réservé à l'usage des caisses de sécurité sociale ou des mutuelles complémentaires.
Conformément aux dispositions de la loi INFORMATIQUE ET LIBERTES (*), nous vous informons que vous pourrez avoir accès à votre dossier en vous adressant à la Direction de l'établissement
(*) articles 26, 27, 34 et 40 de la loi n° 78-17 du 6 janvier 1978 fichiers et aux libertés.

DROIT D'IMAGE. AUTORISATION PARENTALE.

Conformément à la Loi n° 70-643 du 17 juillet 1970 annexe 2 relative à la protection de la vie privée : cet accord ne vaut qu'à la condition d'un engagement écrit et signé des parents ou du représentant légal. Son signataire se réserve le droit de suspendre par la suite cette autorisation sur simple avis.

Je soussigné(e) *(Nom et Prénom)*

demeurant

agissant en qualité de représentant légal de l'enfant *(Nom et Prénom)*

autorise ☐	n'autorise pas ☐	les professionnels du Centre Ressources Autisme à filmer mon enfant/à me filmer au cours du bilan d'évaluation réalisé dans les locaux du CRA.
autorise ☐	n'autorise pas ☐	l'utilisation des images pour l'équipe et la formation des personnels, à l'intérieur du service.
autorise ☐	n'autorise pas ☐	l'utilisation des images dans le cadre de programmes de recherche, de programmes d'enseignement à l'extérieur du service.

Fait à Nice le

Signature