- **Internship title:** How to do better than deep learning ? Network recurrent weight adjustment
- **Hosted by (lab, ...):** Inria
- **Team:** https://team.inria.fr/mnemosyne
- **Place (town, country):** Sophia-Antipolis, France
- **Main advisor:** Thierry Viéville <thierry.vieville@inria.fr> http://www-sop.inria.fr/members/Thierry.Vieville in collaboration with Thalita Firmo-Drumond https://www.linkedin.com/in/thalita-drumond and Xavier Hinaut https://sites.google.com/site/xavierhinaut
- **Required or appreciated skills**: Interest in machine learning and neuroscience. Skill in coding (here C/C++).
- **Context of the internship:**
  - Deep learning and other machine learning methods have now impressive performances. They however need huge number of processing units while restrained to very simple feed-forward architectures. On the reverse biological nervous system have more complex architectures and even small groups of neurons can solve sophisticated task, as observed in small animals, and studied in bio-inspired robotics [3] and systemic neuroscience [4].
  - Our assumption is that recurrent weight adjustment inside a network of computation units (e.g., an artificial neuron network) is still an unsolved problem, so that only restrained architectures or restrained kind of units can be used in practice, though it is not the case in biological systems.
  - However, recurrent neural network weight estimation though backward tuning, seems to be an interesting solution, biologically plausible, and preliminary results show that it works with several kind of units and several criteria to optimize [1], including considering statistical criteria related to biological network activity [2].
    - The goal of the Internship is to further explore this new track.
- **Detailed description:**
  - **Proposed work**
    - At the theoretical level it is propose to revisit the backward tuning method, and study to which extent this can be generalized to sparse estimation methods, i.e., not only learn the network parameter values, but also its architecture.
    - At the implementation level the student is going to co-develop the existing middle-ware with the group and is invited to participate in its dissemination. Implementing the core of the algorithm in a distributed paradigm is going to be the main challenge, allowing us to plugin the code in the main platform such as Tensorflow.
    - At the experimental level, he or she will quantify the performance of this method, especially on rather large computational problems, in link with biological cognitive tasks, a calculation cluster being available to this end.
    - At a more prospective level, she or he, will be asked to consider how this capability to adjust highly recurrent network with adaptable architecture can lead to new computational paradigms, closer to biological systems skills.
  - **Internship organization**
    - The student is going to work at https://www.inria.fr/centre/sophia with Thierry Viéville within the https://team.inria.fr/mnemosyne (which is itself located in Bordeaux), thus with one or two travels to Bordeaux.
    - The student « gratification » is of about 500€/months, all professional travels and expenses during the Internship being paid by Inria.
    - Please contact Thierry Viéville <thierry.vieville@inria.fr> +33 6 13 28 64 59 for any question.
- **Keywords:**
  - machine learning, computational neuroscience, recurrent networks.
- **References:**
  - [1] Recurrent neural network weight estimation though backward tuning, 2017, submitted to J. Comp. Neuroscience, https://vthierry.github.io/mnemonas/main.pdf

- [2] PRANAS: A new platform for retinal analysis and simulation, 2017, Bruno Cessac, Pierre Kornprobst, Selim Kraria, Hassan Nasser, Daniela Pamplona, Geoffrey Portelli, Thierry Viéville, in press for Frontiers in Neuroscience, https://hal.inria.fr/hal-01377307
- [3] Rapid Prototyping for Bio–Inspired Robots, 2017, Maria-Jose Escobar, Frédéric Alexandre, Thierry Viéville, Adrian Palacios in Rapid Roboting: Recent Advances on 3D Printers and Robotics , Springer, pp.300, 2017, Intelligent Systems, Control and Automation: Science and Engineering, http://www.springer.com/us/book/9783319400013
- [4] From biological to numerical experiments in systemic neuroscience: a simulation platform, Nicolas Denoyelle, Maxime Carrere, Florian Pouget, Thierry Viéville, Frédéric Alexandre, A.R. Londral, P. Encarnação. Advances in Neurotechnology, Electronics and Informatics, 12, Springer, 2015, Biosystems & Biorobotics, https://hal.inria.fr/hal-01227968
- [5] L'apprentissage profond : une idée à creuser ? Ikram Chraibi Kaadoud, Thierry Viéville, Interstices, INRIA, 2016 https://hal.inria.fr/hal-01309315

Sujet : [m2r_encadreurs] Sujets de stage master SIF
Date : Tue, 22 Aug 2017 11:45:01 +0200 (CEST)
De : Maud Marchal <maud.marchal@irisa.fr>
Répondre à : Maud Marchal <maud.marchal@irisa.fr>
Copie à : m2r resp <m2r_resp@irisa.fr>

Sujets de stage du master recherche, nouvellement intitulé master Science Informatique (SIF), pour l'année 2017-2018. La rentrée du master (http://master.irisa.fr) est fixée au 11 septembre. Les étudiants ont jusqu'au 19 octobre pour faire leur choix de stage (ils rédigent au premier semestre une étude bibliographique sur le thème de leur stage).
Pour soumettre votre sujet, utiliser le lien suivant : http://master.irisa.fr/internship/submit
Votre sujet de stage sera validé avant d'apparaître en ligne sur la page suivante : http://master.irisa.fr/internship/list.php
Nous demandons aux étudiants de faire valider leur premier choix de stage en vous demandant de signer leur fiche de choix de stage (cela nous permet de vérifier que l'étudiant est bien passé vous voir, et a l'accord de principe de l'accueil dans le labo).
Nous vous rappelons également que le dépôt d'un sujet et l'acceptation d'un stagiaire sont liés à l'acceptation des engagements indiqués dans le vademecum de l'encadrant : http://master.irisa.fr/internship/guide.php
Pour tout besoin d'informations complémentaires, n'hésitez pas à nous contacter : m2r_resp@irisa.fr