Offre n°2024-07999

Ingénieur pour le développement de Nilearn

Type de contrat : CDD

Contrat renouvelable : Oui

Niveau de diplôme exigé : Bac + 5 ou équivalent

Fonction : Ingénieur scientifique contractuel

A propos du centre ou de la direction fonctionnelle

Le centre de recherche Inria de Saclay a été créé en 2008. Sa dynamique s'inscrit dans le développement du plateau de Saclay, en partenariat étroit d'une part avec le pôle de l'Université Paris-Saclay et d'autre part avec le pôle de l'Institut Polytechnique de Paris. Afin de construire une politique de site ambitieuse, le centre Inria de Saclay a signé en 2021 des accords stratégiques avec ces deux partenaires territoriaux privilégiés.

Le centre compte 40 équipes-projets , dont 27 sont communes avec l'Université Paris-Saclay ou l'Institut Polytechnique de Paris. Son action mobilise plus de 600 personnes , scientifiques et personnels d'appui à la recherche et à l'innovation, issues de 54 nationalités.

Contexte et atouts du poste

Dans le cadre d'un partenariat

- non pertinent

L' objectif est de développer et maintenir un logiciel pour l'analyse de données de neuroimagerie

Des déplacements réguliers sont prévus pour ce poste ? Non

Mission confiée

After over a decade of development, Nilearn is now a core tool in the open Python ecosystem, focusing on statistical and machine learning analyses of functional magnetic resonance imaging (fMRI) data. With the support of the CZI EOSS Cycle 5 award from 2022-2024, we have improved core support for General Linear Modelling (GLM) statistical analyses. This, in turn, has afforded developer time for significant improvements of visualization and computational support as well as for important codebase modernization efforts. These changes place us in a better position to push for a more comprehensive Nilearn integration with data standards that have developed in the neuroimaging ecosystem over the last decade.

Movement towards an open, Python-based tooling ecosystem (Poldrack et al., 2018, Annu. Rev. Biomed. Data Sci.) has created space for other methods-focussed community initiatives. Notably, the Brain Imaging Data Structure (BIDS, Gorgolewski et al., 2016, _SciData, _https://github.com/bids-standard) has emerged as a core, community-driven standard for organizing and sharing neuroimaging datasets. BIDS has seen rapid uptake across research groups, facilitating data management and sharing best-practice through platforms such as OpenNeuro (Markiewicz et al., 2021, *Elife*). This has catalyzed the development of automated processing pipelines such as fMRIprep (Esteban et al., 2019, *Nat. Methods*) that can intelligently ingest BIDS datasets and produce standardized output, massively accelerating research workflows. We propose to modernize Nilearn's support for research best practice by integrating with these very widely used community standards and tools.

While many projects have aimed to push forward their integrations with BIDS, Nilearn's interface would have a particularly large impact on the ecosystem. Currently, users regularly request facilitating access to new datasets and atlases through Nilearn, simply because they have difficulty programmatically accessing these resources in their analysis workflows. This is despite the large number of programmatically accessible open datasets: more than a 1000 on OpenNeuro (https://openneuro.org/) alone, representing approximately 50,000 participants and 65 terabytes of data. In addition to solidifying support for BIDS datasets, Nilearn has only minimally supported two of the major initiatives within BIDS: standardized connectivity analyses and metadata reporting. Specifically, Nilearn enables users to perform multiple kinds of functional connectivity analysis; however, best practice in this area has evolved beyond these basic metrics. Further, while we provide dedicated 'reports' to visualize and share a subset of analyses within Nilearn such as our dedicated GLM reports, these connectivity analyses have no standardized reporting mechanism.

We propose to improve Nilearn's integration with the BIDS community along three main axes:

1. Improve Nilearn interoperability with BIDS datasets and atlases, facilitating the reuse of thousands of subject's data
2. Augment Nilearn's support of common functional connectivity statistical and machine learning analyses
3. Extend support for standardized metadata reporting by improving our reporting functionality

As Nilearn is among the most used neuroimaging and machine learning Python packages, this proposal will significantly improve access to best practice for researchers working within the open neuroimaging ecosystem.

Principales activités

Nilearn occupies a prominent place in the neuroimaging in python (NiPy) ecosystem; however, other important community efforts have also emerged over the last decade that guide neuroimaging best practice. BIDS (the Brain Imaging Data Structure) is the most significant of these as a data structure for organizing and documenting neuroimaging files—and increasingly, results. BIDS has unified the vast majority of the neuroimaging community around a dataset standard, resulting in hundreds of laboratories using BIDS.

Despite the strong overlap of their two communities, Nilearn currently has limited support for BIDS. This proposal aims to address this gap by developing deeper integrations with the open and collaborative BIDS community of practice. Our team is composed of Nilearn core developers with very strong links with BIDS (R. Gau is a maintainer, E. DuPre is a contributor, and JB Poline is one of the original founders).

Specifically, we will improve Nilearn support for BIDS around three core axes:

First, **improving Nilearn access to data and brain atlases in BIDS formats.**

Nilearn supports access to a limited number of datasets and brain atlases to support our example gallery, but users consistently ask for more. We intend to expand the list of brain atlases that can be accessed through Nilearn and ensure that they are returned to users or represented on disk in a consistent and structured manner (aimed to be compatible with the BIDS guidelines). Similarly, there is a wealth of BIDS raw and preprocessed open datasets, many of them hosted on the OpenNeuro platform. Solutions such as neurobagel (https://neurobagel.org/) are emerging to ease systematic OpenNeuro interactions to find a list of datasets matching a query. Yet Nilearn users have no easy and high level access to these datasets. Interfacing with OpenNeuro datasets would alleviate this pain point for many users. We propose to develop fetchers to access the list of datasets provided by tools from the BIDS standard ecosystem.

Second, **extending Nilearn support for connectivity analysis of BIDS preprocessed datasets. **

Our last CZI proposal focused on the General Linear Model (GLM) integration, since this is a core focus of fMRI analysis and has been poorly supported in Python open source tooling. However, brain functional connectivity is—at least—an equally widely-used analysis strategy in the field. While Nilearn has support for calculating functional connectivity, it has not incorporated many of the recent best practices for statistically analyzing derived connectomes. We propose to improve our support for these analyses, at scale, by (1) developing interfaces that automate connectivity analysis on BIDS derivatives datasets (for example, those preprocessed with fMRIprep) with minimal configuration, (2) expand the scope of available connectivity metrics (for example cyclic analysis, nilearn/nilearn#4124) and develop functionality for their appropriate statistical assessment using established null models. This will mirror advances we have made in GLM functionality, such as the first_level_from_bids user interface, and extend the same intelligent analysis to connectivity use cases.

Finally, **improving Nilearn report outputs by leveraging BIDS derivatives standards.**

Nilearn can help with diverse brain connectivity analyses and to generate insightful visualizations. Yet, currently, Nilearn outputs are poorly documented and their reusability could be enhanced. Whereas for GLM outputs Nilearn provides utilities that structure the way the results are saved to disk, in the case of brain connectivity analysis it defers the responsibility to users for determining how to save results. Moreover, the HTML reports generated by Nilearn for a given analysis often lack the metadata detailing how results were generated which may compromise the results interpretability.

Ongoing efforts around BIDS derivatives aims to provide a framework for brain connectivity analysis to define how to structure the outputs and what are necessary metadata for ensuring their reusability. We propose to participate in the BIDS derivative development and have Nilearn implement the current first version of BIDS derivatives for the brain connectivity outputs (https://bids.neuroimaging.io/bep017). By better following these guidelines, this will ensure more complete Nilearn visual reports and provide a data structure that users can easily adopt for their output.

Collectively, these changes would significantly improve Nilearn's interactions with both the BIDS community specifically as well as the research teams using these tools more generally. We will iteratively assess all user-facing functionality by extending our documentation (https://nilearn.github.io), showcasing these improvements in real analytic workflows.

Compétences

Compétences techniques et niveau requis : Python expert, expert en analyse de données en neuroimagerie

Langues : anglais

Compétences relationnelles : animation d'une communauté open source

Compétences additionnelles appréciées : -

Avantages

- Restauration subventionnée
- Transports publics remboursés partiellement
- Congés: 7 semaines de congés annuels + 10 jours de RTT (base temps plein) + possibilité d'autorisations d'absence exceptionnelle (ex : enfants malades, déménagement)
- Possibilité de télétravail et aménagement du temps de travail
- Équipements professionnels à disposition (visioconférence, prêts de matériels informatiques, etc.)
- Prestations sociales, culturelles et sportives (Association de gestion des œuvres sociales d'Inria)
- Accès à la formation professionnelle
- Sécurité sociale

Rémunération

Selon expérience

Informations générales

- **Thème/Domaine :** Neurosciences et médecine numériques
  Biologie et santé, Sciences de la vie et de la terre (BAP A)
- **Ville :** Palaiseau
- **Centre Inria :** Centre Inria de Saclay
- **Date de prise de fonction souhaitée :** 2024-09-01
- **Durée de contrat :** 12 mois
- **Date limite pour postuler :** 2024-08-31

Contacts

- **Équipe Inria :** MIND
- **Recruteur :**
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A propos d'Inria

Inria est l'institut national de recherche dédié aux sciences et technologies du numérique. Il emploie 2600 personnes. Ses 215 équipes-projets agiles, en général communes avec des partenaires académiques, impliquent plus de 3900 scientifiques pour relever les défis du numérique, souvent à l'interface d'autres disciplines. L'institut fait appel à de nombreux talents dans plus d'une quarantaine de métiers différents. 900 personnels d'appui à la recherche et à l'innovation contribuent à faire émerger et grandir des projets scientifiques ou entrepreneuriaux qui impactent le monde. Inria travaille avec de nombreuses entreprises et a accompagné la création de plus de 200 start-up. L'institut s'efforce ainsi de répondre aux enjeux de la transformation numérique de la science, de la société et de l'économie.

L'essentiel pour réussir

· Love high-quality code and open source
· Worry about users and like to communicate
· Be curious about data (ie like looking at data and understanding it)
· Have an affinity for problem-solving tradeoffs
· Good scientific Python coders
· Enjoy interacting with a community of developers
· Interest in brain imaging and its applications.
· Experience in optimization is a plus.

Attention: Les candidatures doivent être déposées en ligne sur le site Inria. Le traitement des candidatures adressées par d'autres canaux n'est pas garanti.

Consignes pour postuler

Sécurité défense :
Ce poste est susceptible d'être affecté dans une zone à régime restrictif (ZRR), telle que définie dans le décret n°2011-1425 relatif à la protection du potentiel scientifique et technique de la nation (PPST). L'autorisation d'accès à une zone est délivrée par le chef d'établissement, après avis ministériel favorable, tel que défini dans l'arrêté du 03 juillet 2012, relatif à la PPST. Un avis ministériel défavorable pour un poste affecté dans une ZRR aurait pour conséquence l'annulation du recrutement.

Politique de recrutement :
Dans le cadre de sa politique diversité, tous les postes Inria sont accessibles aux personnes en situation de handicap.