2018-00585 - Post-doctoral position: Automatic classification of lattice walks

Level of qualifications required: PhD or equivalent
Function: Post-Doctoral Research Visit

About the research centre or Inria department

Located at the heart of the main national research and higher education cluster, member of the Université Paris Saclay, a major actor in the French Investments for the Future Programme (Idex, LabEx, IRT, Equipex) and partner of the main establishments present on the plateau, the centre is particularly active in three major areas: data and knowledge; safety, security and reliability; modelling, simulation and optimisation (with priority given to energy).

The 450 researchers and engineers from Inria and its partners who work in the research centre’s 31 teams, the 100 research support staff members, the high-level equipment at their disposal (image walls, high-performance computing clusters, sensor networks), and the privileged relationships with prestigious industrial partners, all make Inria Saclay Île-de-France a key research centre in the local landscape and one that is oriented towards Europe and the world.

Context

Classifying lattice walks in restricted lattices is an important problem in combinatorics and in probability theory. The principal question is: how many possibilities are there to go from some prescribed starting point in some prescribed grid with some prescribed number of steps to some prescribed ending point. For example, on a chess board, how many different paths can the king take from A1 to H8 in n moves, where n is a parameter? The answer is a certain sequence of numbers and it is of interest to find a closed form, or a recurrence, or an asymptotic form of this sequence, or at least some of its algebraic properties. Recently, computer algebra has been used to explore and to solve a number of difficult questions of type kind. The most important outcome is a complete understanding and classification of models of walks in the quarter plane with small steps, including structural properties and explicit formulas. The very recent habilitation memoir presents an overview of these results, with an emphasis on the algorithmic methodology.

Assignment

The difficulty (and beauty!) of this work is that it lies at the crossroad of two different fields — computer algebra and enumerative combinatorics. Most of the previous studies in this context focussed on models of walks with small steps. The applicant’s mission will be to generalize as much as possible of this to walks with general, larger steps.

Main activities

A very first objective of the work will be to absorb the existing literature on this basic case. The next challenge will then be to improve the computer algebra algorithms used to answer these combinatorial questions, notably several steps used during the (automated) “guess-and-prove” technique: data generation (e.g., “how to compute quickly terms of a univariate sequence without computing useless terms of a multivariate sequence?”), guessing equations (e.g., “how to compute Hermite-Padé approximants faster in the algebraic and differential cases?”), proving guessed equations (e.g., “how to compute faster resultants of structured multivariate polynomials?”). The theoretical algorithmic advances should be concretized by convincing implementations. Finally, the main goal will be to extend the algorithmic approach to models with larger steps.

Skills

Applicants must have a PhD in Computer Algebra or Computational Mathematics. They must show a taste for both mathematics (algebra and combinatorics) and for computer programming on mathematical objects.

Benefits package

- Subsidised catering service
- Partially-reimbursed public transport
- Social security
- Paid leave
- Flexible working hours

General Information

- Theme/Domain: Algorithmics, Computer Algebra and Cryptology
- Town/city: PALAISEAU
- Inria Center: CRI Saclay - Île-de-France
- Starting date: 2018-11-01
- Duration of contract: 1 year, 4 months
- Deadline to apply: 2018-04-10

Contacts

- Inria Team: SPECFUN
- Recruiter: Chyzak Frederic / frederic.chyzak@inria.fr

Conditions for application

Applicants have to provide the following documents to be considered at the selection procedure:

* CV
* publication list and 2 representative publications (that you judge representative of your work)
* motivation letter (explaining why the selected topic, how do you think you can fit the topic, what are your motivations for the topic compared to your previous work, etc)
* 2 recommendation letters
* perspective of professional insertion after the post-doc

Defence Security:

This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST). Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy:

As part of its diversity policy, all Inria positions are accessible to people with disabilities.

Warning: you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.
Sports facilities

Remuneration
Monthly gross salary: 2,653 euros