

Fonds de la Recherche Scientifique - FNRS

EVALUATION FINAL REPORT / RAPPORT FINAL D'ÉVALUATION

Appel/Call "Bourses et Mandats/Grants and Fellowships" 2025 - Postdocs

REFERENCES OF THE APPLICATION / RÉFÉRENCES DE LA DEMANDE

Chargé de recherches [CR]

Commission : SEN-3 Sciences Exactes et Naturelles - 3

Application ID / N° de la demande : 40032149

Host institution / Institution d'accueil : Université catholique de Louvain

Participant·e·s :

PISANU Francesco [Applicant / Proposant]

CATANZARO Daniele (UCLouvain) [Promoter / Promoteur]

Titre de la proposition :

TREES : Modèles, méthodes et algorithmes avancés pour l'estimation phylogénétique

Proposal title:

TREES: Advanced models, methods, and algorithms for phylogenetic estimation

EVALUATION FINAL REPORT / RAPPORT FINAL D'ÉVALUATION

Commission report / Rapport de la Commission

Criterion : The researcher / Critère : Le chercheur

The applicant is qualified to lead the proposed research project. He has shown that he can integrate well in research teams and has collected experience and international contacts in the research area.

His indicators in terms of scientific output and academic visibility are modest given his career stage.

Criterion : The research project / Critère : le projet de recherche

The project investigates the solution to the balanced minimum evolution network design problem via the dual integrality and polyhedral theory, thus combining the expertise of the researcher with that of the host team at UCLouvain.

The approach is novel and technically sound. The proposal is clear and well-written and identifies potential contributions that are relevant within the field of combinatorial optimization.

The work plan is structured according to a well-defined set of steps. Alternative paths are anticipated in case not all ambitious goals can be fully achieved.

Criterion : The research environment / Critère : L'environnement de recherche

The research environment is excellent, particularly in terms of the group of researchers collaborating to the project. This environment will undoubtedly contribute to the project development and support its effective implementation through the appropriate computational resources.

Final comment / Commentaire final

This is an excellent proposal by a promising researcher. The project is well-structured and has potential for impact in the field of phylogenetics. The objectives are ambitious and somewhat risky, but they are clearly acknowledged and supported by the expertise of the applicant and of the hosting team.

Commission final grading / Note finale donnée par la Commission

A : Excellent / A : Excellent

INDICATION CONCERNANT VOTRE CLASSEMENT / INDICATION OF YOUR RANKING

Votre demande ne fait pas partie des 50% des demandes les mieux classées / Your application is not part of the 50% best ranked applications

DECISION OF THE BOARD OF TRUSTEES / DÉCISION DU CONSEIL D'ADMINISTRATION

Rejection of the proposal due to a lack of financial means / Rejet de la proposition faute de moyens financiers

REMOTE EVALUATION REPORTS (1ST STEP) / RAPPORTS D'ÉVALUATION À DISTANCE (ETAPE 1)

[Review 215611]

Criterion : The researcher / Critère : Le chercheur

Strengths / Forces

- + The applicant is a young researcher who obtained a PhD in late 2023. His academic background is highly relevant to the theme of the project, making it well aligned with the case under study.
- + The applicant scientific record includes concrete contributions that have advanced the field, particularly within the specific domain addressed by this project.

Weaknesses / Faiblesses

- The candidate scientific output remains quite limited. Even considering his status as an early-career researcher, the number of publications in high-impact journals is low, especially given that he was already enrolled in a postdoc at UCLouvain.
- The applicant mentions the specificity of his research field to justify the low number of citations. While this may partly explain the situation, the overall citation count is very low, indicating a limited level of recognition from the scientific community so far.

General comment / Commentaire général

The applicant is clearly qualified to lead a project of this type. The specific characteristics of his research field may partly explain some of the still modest indicators, particularly the low number of citations. However, both in terms of scientific output and academic visibility, the figures remain considerably below what would be expected for a researcher at his current career stage. This raises some concerns regarding scientific maturity and peer recognition.

Criterion : The research project / Critère : le projet de recherche

Strengths / Forces

- + As acknowledged by the applicant, the project objectives are ambitious and challenging. The candidate demonstrates a clear awareness of this and anticipates alternative paths in case not all initial goals can be fully achieved.
- + The proposal identifies potential contributions that are precise and relevant within the field of combinatorial optimization.
- + The applicant has a reasonably clear idea of the direction to follow, which is reflected in a work plan that, although presented in broad terms, describes a rather well-defined set of steps and methodological approaches.

Weaknesses / Faiblesses

- The risks associated with the project are acknowledged and briefly discussed. However, the mitigation strategies would have benefited from a more in-depth analysis, especially considering the possibility that some of the project objectives may not be fully achieved.

General comment / Commentaire général

The applicant presents a well-structured and relevant project in a field in which he is a specialist. The objectives

set for the project are ambitious and somewhat risky, but they are clearly acknowledged and validated by the promotor of applicant himself.

Criterion : The research environment / Critère : L'environnement de recherche

The research environment: the intellectual, human, equipment means, collaborative networks at the disposal of the researcher in order to carry out the project, in adequacy with the project submitted. / L'environnement de recherche : moyens (intellectuels, humains, matériels, réseaux collaboratifs...) dont le chercheur dispose pour mener à bien son projet, en adéquation avec le projet proposé.

Strengths / Forces

- + The scientific hosting conditions are of the highest level. The applicant will have the opportunity to interact with internationally recognised peers in the field.
- + At CORE of UCLouvain, the applicant will also be able to work closely with experts in the specific domain addressed by the project.

Weaknesses / Faiblesses

- The applicant has already completed a postdoctoral stay at the host institution, and continuing at the same place suggests limited scientific mobility, which is viewed as a negative aspect in a scientific career.

General comment / Commentaire général

The research environment is excellent, particularly in terms of the group of researchers working in the project field. This environment will undoubtedly contribute to the project dynamism and support its effective implementation.

Global comment / Commentaire global

The project is a good project. It addresses a domain that is both relevant and complex. The applicant has set ambitious objectives, and successfully achieving them would represent a notable contribution to the state-of-the-art. He clearly has the academic background needed to work on this topic. However, his scientific track record remains quite limited, which raises concerns regarding his credibility and ability to deliver strong research outputs.

Ethical issues / Aspects éthiques

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Irrelevant / Non applicable

Indicate an optional comment regarding the ethical aspects of the proposal. / Indiquez un commentaire optionnel relatif aux aspects éthiques de la proposition.

No comment / Pas de commentaire

[Review 215045]

Criterion : The researcher / Critère : Le chercheur

Strengths / Forces

Seems to be at the cutting edge of research in combinatorial optimization.

Previous publications show a nice mix of theory development with concrete applications. Reasonable number of publications for someone that finished their PhD in 2023.

Weaknesses / Faiblesses

Limited previous experience in phylogenetics (this is not necessarily a weakness - sometimes a fresh perspective on an old problem is very useful)

General comment / Commentaire général

I think that the candidate would bring a very useful skill set to the described problem. The strength of the supporting research environment and the proposed collaborations should mitigate the weakness in their phylogenetic background. Overall, I think the field of phylogenetics could use more researchers with a strong combinatorial optimization background - so this project would constitute valuable interdisciplinary training for a early career researcher.

Criterion : The research project / Critère : le projet de recherche

Strengths / Forces

The proposal outlines a range of very interesting ideas for making practical advances to the BMEP. The link to the travelling salesman problem seems particularly promising given that it is a well-known NP-hard problem that is nevertheless practically solvable for large instances.

Good to see that the proposal includes work on approximation algorithms as well as exact solutions. I think that in very many application areas having a solution that is close to optimal is sufficient.

The fact that there are several independent promising lines of enquiry gives the project robustness, as if one or two things don't work and the others do that would still mean a useful advance to the field.

The collaborators that have been identified have a very useful skill set that's well matched to the problem.

Weaknesses / Faiblesses

It would have been good to see a collaborator with some software development experience in the event that new methods are developed that require implementation. That said, I think it is fine that this aspect is left out of the 3-year plan as there is certainly enough to explore mathematically in the ideas proposed.

Would have been good to see a little more detail on the link to TDIness.

General comment / Commentaire général

Overall, I think the proposed research areas seem promising.

Improvements to the theory of BME would make a practical difference to the many users of phylogenetic

methods.

Criterion : The research environment / Critère : L'environnement de recherche

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Strengths / Forces

The CORE (Center for Operations Research and Econometrics) group at Louvain looks like an ideal research environment for this project. Catanzaro is one of the world experts on BME and the broader group adds to a strong collaborative environment.

Weaknesses / Faiblesses

None identified

General comment / Commentaire général

This research seems like a great fit to what CORE do.

They have plenty of computational resources to support the project

Global comment / Commentaire global

I am enthusiastic about this proposal. Phylogenetic methods have a huge community of users, so any advances in the direction of accurate and fast computation of phylogenetic trees are of great benefit.

The project is well thought through in terms of having identified some very promising lines of enquiry. The timeframes seem realistic.

The project plus research environment will contribute to development of Pisanu as a future research leader in the area of combinatorial phylogenetics.

Ethical issues / Aspects éthiques

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Irrelevant / Non applicable

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No comment / Pas de commentaire

[Review 216291]

Criterion : The researcher / Critère : Le chercheur

Strengths / Forces

The applicant is young doctor with 2 years of experience that graduated in Sorbonne Paris Nord in 2023. His previous experience in detecting Box-TDi combinatorial structures can be applied to advance about the knowledge of the BMEP, one of the problems considered in this proposal.

Weaknesses / Faiblesses

The number of publications related with the scope of the proposal is reduced to one. Specifically, there is no previous expertise on BMEP or on unrooted binary trees. There is also some lack of expertise on approximation algorithms.

General comment / Commentaire général

The candidate profile expertise concerning the goal of this proposal is limited with few publications and even less related with the scope the project.

Criterion : The research project / Critère : le projet de recherche

Strengths / Forces

The project investigates a class of highly nonlinear NP-hard network design problems defined over Unrooted Binary Trees (UBT). It seeks to extend foundational mathematical and algorithmic theory underlying Distance Methods (DMs) in phylogenetics. The Project also elaborates on the Balanced Minimum Evolution (BME) problema because of its ties with phylogenetics. There are two main goals:

1. Advancing on the basic polyhedral combinatorics of the BMEP
2. Advancing dedicated algorithms for UBT optimality
3. Developing efficient algorithms for real-size instances

The project is structured around three interconnected research lines whose join análisis makes sense. There is a detailed 3 years work plan. In the first year, the applicat will focus on theoretical investigations to bypass Buneman's conditions. During the years 2 and 3 he will focus on developing algorithms. The plan includes: (i) designing new approximation algorithms leveraging connections with STSP and planar structures; (ii) investigating local certificates to validate solutions under minor perturbations of evolutionary distances; (iii) addressing numerical instabilities in the BMEP objective function, providing explicit error bounds for robust computations.

Weaknesses / Faiblesses

The project proposal does not fit well with the applicant profile, although it is interesting. In spite of that, there is one goal which involves a lot of risk. This is the STSP approach to the BMEP based on a specific manifold that seem to verify the instances of both problems. This is a very non-conventional approach that may have very high risk of being non promising.

The publication plan is somehow too ambitious: 2 publications based on the first goal plus another paper based and a letter based on thee second goal, in years 2 and 3. This is very difficult. Developing the results if achieved, writing, revising, submitting...;

General comment / Commentaire général

Overall, the proposal is interesting and may give rise to some results. At some points is too ambitious.

Criterion : The research environment / Critère : L'environnement de recherche

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Strengths / Forces

The promotor Prof. Catanzaro is an expert in the field so that the applicant will have proper guidance. The CORE (Center for Operations Research and Econometrics) at UCLouvain is an exceptional environment for conducting this project on evolutionary trees. Directed by Prof. Daniele Catanzaro, an expert in combinatorial optimization and evolutionary trees, the CORE is equipped with intellectual and material resources that align perfectly with the project's needs.

Additionally, the applicant will benefit from the mentorship of Prof. Laurence Wolsey, a renowned scholar in integer programming and combinatorial optimization. His experience in addressing complex optimization problems, including those related to evolutionary trees, provides a unique advantage in advancing the methodological aspects of this research.

The CORE's collaborative ethos, combined with its access to cutting-edge computational resources, ensures a robust framework for the successful realization of this project.

Weaknesses / Faiblesses

No comment

General comment / Commentaire général

The work environment is the adequate for developing this project, provided it were funded.

Global comment / Commentaire global

The application is rather good but the candidate CV is a bit weak.

Ethical issues / Aspects éthiques

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Irrelevant / Non applicable

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No comment / Pas de commentaire

[Review 216292]

Criterion : The researcher / Critère : Le chercheur

Strengths / Forces

The research project is intended to be done at UCLouvain in the next 3 years.

The applicant is already working in this center from September 2024 until August 2025.

This is positive, ensuring that the applicant is already familiar with the research team and place.

Previously, the applicant spent 3 years at Université Paris Nord (France), where he got his PhD in 2023, and even before he completed a Master degree at the University of Cagliari (Italy) in 2019.

The topic of the Master, PhD and this research proposal are all strongly related to Mathematics.

There are complementary differences since the PhD was on Fundamental Theory (particularly on Dual Integrality) while the new research proposal intends to bring this theory to a specific Combinatorial Optimization problem.

In addition, the applicant also brings experience in Computer Science since he implemented part of his PhD results in Python on an open-source software.

The applicant has published 4 scientific articles, two of which are in good journals:

(a) A. Greco and F. Pisanu. Improvements on overdetermined problems associated with the p-laplacian. *Mathematics in Engineering*, 4(3):1–14, 2022.

(b) P. Chervet, R. Grappe, M. Lacroix, F. Pisanu, and R. Wolfler Calvo. Hard problems on box-totally dual integral polyhedra. *Discrete Optimization*, 50:100810, 2023.

Article (a) is a research result from his Master degree in Italy, and (b) is a research result from his PhD in France.

Taking into account the young age of the applicant, this low number of publications is not negative.

The proposal is very clear and well-written, which is much appreciated. It shows contact with other researchers, including a professor at Université Libre de Bruxelles (Belgium) and another professor at the University of Wisconsin-Madison (USA). Thus, internationalization is also guaranteed.

Weaknesses / Faiblesses

It is a young researcher who has proved success at the master and PhD degrees. There is no proof that the applicant is autonomous, but this project to join a research team at UCLouvain, with a leader already on the research topic. Thus, I do not find any weaknesses in the applicant's CV.

General comment / Commentaire général

The applicant has few but good scientific articles with his supervisors, both at Master and PhD levels. He has proved to integrate well in research teams, even in different countries, and has collected experience and international contacts in the research area.

Criterion : The research project / Critère : le projet de recherche

Strengths / Forces

The proposal is to bring theoretical and practical results from Dual Integrality and Polyedral Theory (collected in Paris during the PhD degree) to a challenging combinatorial optimization problem where the leader of the research team at UCLouvain has been working for many years. The proposal is very clear and well-written, proving that the applicant knows the status of the literature on this topic.

Weaknesses / Faiblesses

Both the topic studied by the applicant before and the topic that is intended to be investigated with this project are of high interest to the Scientific Community. I do not find any remarkable weaknesses in the research proposal. The time planning and workload seem very reasonable, and the place and team to develop it are the best for this project.

General comment / Commentaire général

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Strengths / Forces

This proposal is to add a post-doctoral researcher to a research team at UCLouvain. The leader of this team (Prof Daniele Cantanzaro) is internationally well-known for his contributions to the Balanced Minimum Evolution Problem, which is the target of this proposal, now tackled from a Polyhedral Theory perspective.

Weaknesses / Faiblesses

The proposal does not mention the needs of the research team at UCLouvain.

It is unclear whether the research team already have other post-doctoral students working on related topics.

I assume that adding a new post-doctoral researcher is feasible since the research proposal is very interesting and promising.

General comment / Commentaire général

The research question in this proposal is of high interest. The team at UCLouvain is the best to develop it. The candidate is a young researcher with proven integration in research groups and results, bringing international scientific contacts.

Global comment / Commentaire global

The applicant is young, with little experience, but it is remarkable that in a short time, he has published a good research article from his master's degree in Italy and another good article from his PhD degree in France. He started working at UCLouvain (Belgium) very recently, which shows good integration with the new group. The research topic is of interest and certainly, the applicant is bringing knowledge from a different area that will contribute positively both to the topic and to the group at UCLouvain. I wish I could get such a post-doctoral student in my research team. I strongly recommend to support this project.

Ethical issues / Aspects éthiques

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Irrelevant / Non applicable

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It is in Mathematics. There is no negative ethical aspect in this proposal.