



UNIVERSIDADE DE ÉVORA

Centro de Investigação em Matemática e Aplicações

Bachelor's Degree Scholarship - 1 vacancy

28 of August of 2023

A call for tenders is open for one Bachelor's Degree Scholarship enrolled in a Master, Reference CIMA/BI_MMEAD/2023 within the scope of the project with reference **UIDB/04674/2020**, Multi-year financing 2020-2023 of CIMA financed by national funds through FCT/MCTES, under the following conditions:

Scientific area: Mathematics

Admission requirements:

Students with a Bachelor's Degree enrolled in the Master's in Statistical Modelling and Data Analysis at the University of Évora

As set forth FCT Research Scholarship Regulation No. 950/2019 of December 16, 2019, article 3 and 6, candidates for "**BI**" (Research Grants) must comply as a rule condition for the award of the scholarship, the effective inclusion in study cycles leading to the attribution of academic degrees or in courses not leading to an academic degree. Courses that do not confer an academic degree correspond to the courses provided for in subparagraph e) of paragraph 3 of article 4 of Decree-Law No. 74/2006 of 24 March and must be developed in a higher education institution in association with at least one R&D unit, including a course plan in one or several research areas of the unit.

Work plan:

Title: Modelling and Prediction of Rare Events - a comparative study

Modelling to predict events that occur with very low frequency, but have a significant impact (usually named rare events), has applications in different areas of knowledge. Indeed, rare events can be natural disasters, industrial accidents, financial crises, frauds, epidemics, and serious traffic car accidents, among others. It is extremely important to identify and predict these events in advance so that preventive measures can be taken to mitigate their consequences.

One of the main challenges in modelling and predicting rare events is the lack of data, which affects the goodness of fit and the predictive ability of statistical models. In particular, in a binary classification model (occurring or not occurring a given event) when there is a large



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imbalance in the number of observations in each class its performance can be greatly affected, the same happening in machine learning models.

To overcome this limitation several approaches have emerged, some at the data level (undersampling and oversampling), others at the level of the algorithms used (using weights in the models) and others mixing the two levels (known as ensemble methods, for instance Boosting and Bagging). Deep learning models have also been proposed.

The choice of the appropriate method to model rare events depends on the nature of the available data, the specific context of the problem and the prediction goals. In this work, it is proposed a comparison of several approaches using traffic accident data. The prediction results will be compared considering different measures proposed in the literature.

Applicable legislation and regulations: The granting of the Research Scholarship will be carried out upon the signing of a contract between the University of Évora and the scholarship holder, as set in the template [former.fct.pt/apoios/Minuta_Contrato_Bolsa.docx](https://www.fct.pt/apoios/Minuta_Contrato_Bolsa.docx), pursuant to the Research Scholarship Statute (Law No. 40/2004 of August 18 and Decree-Law No. 123/2019 of August 28) and in accordance with the legislation and Regulation of Research Grants of the Foundation for Science and Technology, IP in force, regulation nº950/2019 of December 16, 2019: <https://files.dre.pt/2s/2019/12/241000000/0009100105.pdf> and other applicable rules.

Place of work: The work will be developed at CIMA of the University of Évora, under the scientific guidance of the Professors Paulo Infante, Gonçalo Jacinto and Anabela Afonso

Duration of the scholarship(s): The scholarship will have a duration of 12 months, starting on November of 2023.

Amount of monthly maintenance allowance: The amount of the scholarship corresponds to €930,98, according to the table of scholarships awarded directly by FCT, I.P. in Portugal (https://www.fct.pt/wp-content/uploads/2023/02/Tabela-de-Valores-SMM_2023.pdf), payments being made monthly, by check or bank transfer.

Selection methods: The selection methods to be used will be the following, with the respective valuation of

- Curriculum evaluation: 40%;
- Motivation Letter Evaluation - 40%;
- Academic experience in the area of Mathematics – 20%.

Composition of the Selection Jury:

President: Gonçalo João Costa Jacinto (CIMA-EVORA)

1st Vogal: Dulce Gamito Santinhos Pereira (CIMA-EVORA);

2nd Vogal: Paulo de Jesus Infante dos Santos (CIMA-EVORA)

Alternate members:

Anabela Cristina Cavaco Ferreira Afonso (CIMA-EVORA);

Lígia Henriques Rodrigues (CIMA-EVORA)



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Advertising/notification of results: The final results of the evaluation will be publicized, through an ordered list alphabetically, posted in a visible and public place of the Mathematics Department, being the candidate's approval notified through email.

To ensure the right of prior hearing of interested parties, the Final Classification project will be announced by any written means to all interested parties.

After communicating the provisional list of the results of the evaluation, candidates have a period of 10 working days to express their opinion in a preliminary hearing of interested parties.

Application deadline and submission of applications:

The tender is open from 15th of September of to 06th of October 2023 and the results of the selection will be published by 30th of October, 2023.

Applications must be formalized, obligatorily, by sending an application letter with the following documents:

- Curriculum vitae;
- Qualification certificate
- Letter of interest
- Letter of recommendation

For the purposes of application, the evidence may be replaced by a declaration of honor signed by the candidate, but the failure to demonstrate that evidence, in the contracting phase, possession of the required degree on the deadline for application or the non-presentation of proof of enrollment in the study cycle, imply the cancellation of the candidate's application.

Academic degrees obtained in foreign countries require registration by a Portuguese Institution in accordance with Decree-Law no. 66/2018, of August 16 and Ordinance No. 33/2019, of January 25th.

The presentation of the certificate is mandatory for the signing of the contract. More information can be obtained at: <https://www.dges.gov.pt/pt/pagina/recognition?plid=374>

Applications must be sent by email to:

Prof. Feliz Manuel Barrão Minhós
Department of Mathematics of the University of Évora
email: dircima@uevora.pt