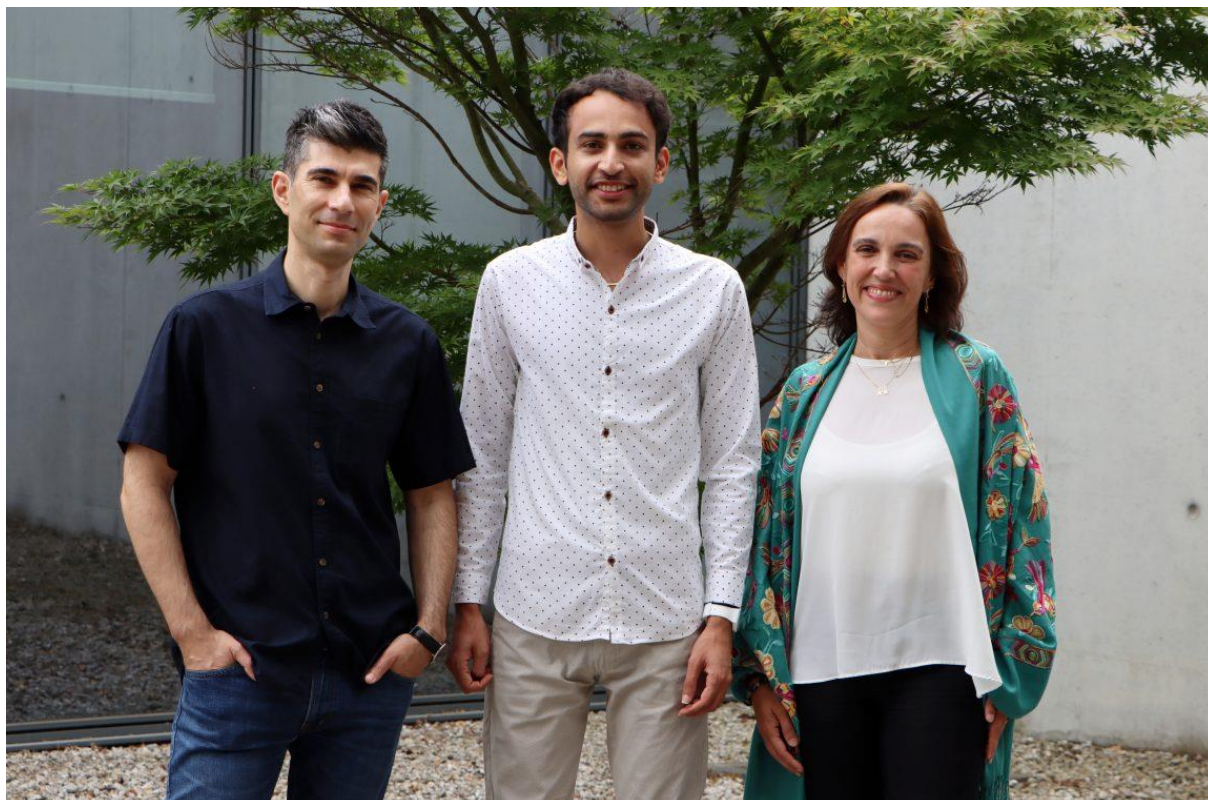


U.Porto: [Doutorando desenvolve IA para transformar microbiomas em provas forenses](#)

Doutorando desenvolve IA para transformar microbiomas em provas forenses

- Por [Nuno Pereira](#) (i3S) 17.07.26

Projeto de doutoramento desenvolvido no i3S e na FCUP procura usar a IA para transformar os microrganismos do corpo em prova forense.



Pedro Gabriel Ferreira (à esquerda), da FCUP, e Nádia Pinto (à direita), do i3S, orientam o trabalho do estudante Ahmad Hassan (ao centro). Fotografia: Adriana Costa/i3S

O conjunto de microrganismos que habitam o nosso corpo, também designado como microbioma, pode transformar-se em fonte de prova em investigação criminal. É este, pelo menos, o desafio proposto pelo projeto de doutoramento de Ahmad Hassan, que está a ser desenvolvido no Instituto de Investigação e Inovação em Saúde (i3S) e na Faculdade de Ciências da Universidade do Porto (FCUP).

Financiada pela União Europeia através das [Marie Skłodowska-Curie Actions – Doctoral Networks](#), no âmbito da rede europeia [NATURAL TRACES](#), a investigação combina tecnologia de *deep learning*, inteligência artificial (IA) generativa e bioinformática, procurando responder a desafios com diversas aplicações práticas, como a geolocalização de vestígios biológicos, a identificação individual e a estimativa do intervalo pós-morte.

“O objetivo deste projeto de doutoramento é desenvolver algoritmos capazes de transformar dados complexos do microbioma em provas forenses sólidas e juridicamente defensáveis”, explica Nádia Pinto, investigadora do i3S.

No i3S, o doutorando Ahmad Hassan terá acesso a um ambiente interdisciplinar que reúne especialistas em genética forense, genética populacional, modelação matemática e ciência de dados. Já no Departamento de Ciência de Computadores da FCUP (DCC-FCUP), o

estudante integrará um ecossistema de investigação nas áreas da IA, da bioinformática e da biologia computacional. “Este ambiente permite desenvolver, testar e validar métodos computacionais e algoritmos avançados que poderão contribuir para traduzir a complexidade dos dados biológicos em soluções tecnológicas inovadoras e robustas”, sublinha Pedro Gabriel Ferreira, professor do DCC-FCUP.

Para Ahmad Hassan, integrar este doutoramento representa uma oportunidade única de formação e colaboração científica global. “Este projeto de doutoramento permite-me crescer como investigador independente, colaborar com parceiros internacionais e contribuir para o avanço da ciência forense de forma a que, no futuro, estas ferramentas possam ser aplicadas por profissionais no terreno e pelo sistema de justiça”, afirma o doutorando. Inscrito no [Programa de Doutoramento em Ciência de Computadores da FCUP](#), Ahmad Hassan é orientado por Pedro Gabriel Ferreira, da FCUP, Nádía Pinto, do i3S, e Daniel Ramos, da Universidade Autónoma de Madrid.

A rede NATURAL TRACES é coordenada pela Universidade de Frankfurt e reúne dez doutorandos, além de beneficiários e parceiros de catorze países. O objetivo principal é desenvolver novas abordagens para utilizar ADN ambiental (eDNA), microbiomas e outros vestígios biológicos não humanos como evidência forense. Entre as diferentes áreas de investigação da rede incluem-se a entomologia forense, a análise de pólen, de fungos e de ADN ambiental, bem como métodos bioinformáticos e de IA para interpretação de dados complexos. No consórcio, o i3S e a FCUP lideram o desenvolvimento de métodos bioinformáticos e de IA aplicados à análise de microbiomas, reforçando a contribuição portuguesa para uma nova geração de ferramentas de apoio à investigação forense.

Segundo Nádía Pinto, este projeto reforça a aposta estratégica do i3S na medicina genómica e na biologia computacional: “Este doutoramento contribui para consolidar a capacidade do instituto no desenvolvimento de ferramentas de aprendizagem automática e de modelos probabilísticos para interpretar dados ómicos complexos [conjuntos massivos de informações biológicas geradas por tecnologias de alto rendimento], demonstrando como estas tecnologias podem gerar impacto para além da saúde, nomeadamente na ciência forense”.

ENGLISH

PhD Student Develops AI to Turn Microbiomes into Forensic Evidence

By Nuno Pereira (i3S)

17 July 2026

PhD project developed at i3S and FCUP aims to use AI to transform microorganisms from the human body into forensic evidence.

Pedro Gabriel Ferreira (left), from FCUP, and Nádía Pinto (right), from i3S, supervise the work of student Ahmad Hassan (centre). Photo: Adriana Costa/i3S

The community of microorganisms that inhabit our bodies, also known as the microbiome, could become a source of evidence in criminal investigations. This is, at least, the challenge addressed by Ahmad Hassan's PhD project, which is being developed at the Institute for Research and Innovation in Health (i3S) and the Faculty of Sciences of the University of Porto (FCUP).

Funded by the European Union through the [Marie Skłodowska-Curie Actions – Doctoral Networks], as part of the European [NATURAL TRACES] network, the research combines deep learning, generative artificial intelligence (AI), and bioinformatics to address challenges with a range of practical applications, including the geolocation of biological traces, individual identification, and estimation of the post-mortem interval.

"The aim of this PhD project is to develop algorithms capable of transforming complex microbiome data into robust and legally defensible forensic evidence," explains Nádía Pinto, a researcher at i3S.

At i3S, PhD student Ahmad Hassan will have access to an interdisciplinary environment bringing together experts in forensic genetics, population genetics, mathematical modelling, and data science. At FCUP's Department of Computer Science (DCC-FCUP), the student will become part of a research ecosystem focused on AI, bioinformatics, and computational biology.

"This environment makes it possible to develop, test, and validate advanced computational methods and algorithms that can help translate the complexity of biological data into innovative and robust technological solutions," emphasises Pedro Gabriel Ferreira, professor at DCC-FCUP.

For Ahmad Hassan, joining this PhD programme represents a unique opportunity for training and global scientific collaboration.

"This PhD project allows me to grow as an independent researcher, collaborate with international partners, and contribute to the advancement of forensic science so that, in the future, these tools can be used by professionals in the field and by the justice system," says the PhD student.

Enrolled in the [FCUP PhD Programme in Computer Science], Ahmad Hassan is supervised by Pedro Gabriel Ferreira from FCUP, Nádía Pinto from i3S, and Daniel Ramos from the Autonomous University of Madrid.

The NATURAL TRACES network is coordinated by the University of Frankfurt and brings together ten PhD students, as well as beneficiaries and partners from fourteen countries. Its main objective is to develop new approaches for using environmental DNA (eDNA), microbiomes, and other non-human biological traces as forensic evidence.

The network's research areas include forensic entomology, the analysis of pollen, fungi, and environmental DNA, as well as bioinformatics and AI methods for interpreting complex data. Within the consortium, i3S and FCUP are leading the development of bioinformatics and AI methods for microbiome analysis, strengthening Portugal's contribution to a new generation of tools to support forensic investigations.

According to Nádia Pinto, this project strengthens i3S's strategic focus on genomic medicine and computational biology:

"This PhD project contributes to consolidating the institute's capacity to develop machine-learning tools and probabilistic models for interpreting complex omics data [large-scale collections of biological information generated by high-throughput technologies], demonstrating how these technologies can create an impact beyond healthcare, particularly in forensic science."

i3S develops AI to turn microbiomes into forensic evidence

The community of microorganisms that inhabit our bodies, also known as the microbiome, could become a new source of evidence in criminal investigations. This is the challenge taken on by Ahmad Hassan's doctoral project, carried out at i3S and at the Faculty of Sciences of the University of Porto (FCUP) as part of the European NATURAL TRACES network, funded by the European Union through the Marie Skłodowska-Curie Actions – Doctoral Networks.

"This doctoral project aims to develop algorithms capable of turning complex microbiome data into robust, legally defensible forensic evidence", explains i3S researcher Nádia Pinto. To this end, the work programme combines deep learning, generative artificial intelligence (AI), and bioinformatics to address challenges with a range of practical applications, such as the geolocation of biological traces, individual identification, and estimation of the post-mortem interval.

At i3S, doctoral student Ahmad Hassan will have access to an interdisciplinary environment bringing together specialists in forensic genetics, population genetics, mathematical modelling, and data science.

For Ahmad Hassan, joining this doctoral programme represents a unique opportunity for training and global scientific collaboration. "This doctoral project allows me to grow as an independent researcher, to collaborate with international partners, and to contribute to advancing forensic science so that, in the future, these tools can be applied by professionals in the field and by the justice system", says the student. Enrolled in FCUP's Doctoral Programme in Computer Science, Ahmad Hassan is supervised by FCUP's Pedro Gabriel Ferreira, i3S's Nádia Pinto, and Universidad Autónoma de Madrid's Daniel Ramos.

The NATURAL TRACES network is coordinated by Goethe University Frankfurt and brings together ten doctoral students, along with beneficiaries and partners from fourteen countries. Its main goal is to develop new approaches to using environmental DNA (eDNA), microbiomes, and other non-human biological traces as forensic evidence. The network's research areas include forensic entomology; the analysis of pollen, fungi, and environmental

DNA; and bioinformatics and AI methods for interpreting these complex data. Within the consortium, i3S and FCUP lead the development of bioinformatics and AI methods applied to microbiome analysis, strengthening Portugal's contribution to a new generation of tools to support forensic investigation.

According to Nádía Pinto, the project reinforces i3S's strategic commitment to genomic medicine and computational biology: “This doctoral project helps consolidate the institute's capacity to develop machine learning tools and probabilistic models for interpreting complex omics data, and it demonstrates how these technologies can have an impact beyond health, particularly in forensic science”.