Title of BIP: Applied Topology, Topological Data Analysis

General information

Objectives and Description: Topological Data Analysis has become an important tool in machine learning and artificial intelligence. The course will provide the needed concepts and methods and tools in homology (persistent homology and persistent diagrams) to have efficient methods to study data clouds and other objects in data analysis

Methods and outcomes: After the course the student should be acquainted with the basic concepts in topological complexes, homology and persistent homology, and its use in data analysis and other subjects, Specifically, they should be able to approximate data clouds and other geometrical objects by topological complexes and filtrations and, calculate the persistent homology of these objects and the persistent diagrams. After the course the participants should be able to give reliable interpretations of the topological invariants in applications in technology and humanities. Besides, they should be able to use software packages to calculate homology of complexes and persistent diagrams, and to carry out analysis of data with these methods.

Field of Education: Mathematics and Artificial Intelligence

Target audience / Participants profile: Undergraduate (4th year), graduate (master or PhD students)

No of ECTS issued: 6

Language of instruction and requirements: English

Dates for physical activity: September 2-13 2024

Location of physical activity: Linköping (Sweden)

Dates for virtual component: From September 16 to November 29 2024

Virtual Component Description: The course will have a virtual classroom where didactical materials (including the recorded on location lectures) will be posted, and where the participants will have digital tests, hand-in exercises and communication channels teacher-student and student-student. We propose meetings via ZOOM. The laborations will be done online.

Organizing Board

Receiving/Host university:

***Linköping University*,** Sweden (Milagros Izquierdo Barrios, milagros.izquierdo@liu.se)

Sending/Partner universities:

P1. UNED, Spain (Antonio Costa, acosta@mat.uned.es)

P2. Universita degli Studi di Modena e Regio Emilia I, Italy (Paola Cristofori, paola.cristofori@unimore.it)

P3. Universitat Autònoma de Barcelona, Spain (Natalia Castellana, Natalia.Castellana@uab.cat)

P4. Universidade Aveiro, Portugal (Tatiana Tchemisova, tatiana@ua.pt)

P5. Universidad de Zaragoza, Spain (Enrique Artal, artal@unizar.es)

Detailed programme

1. **Planned activities during virtual component:**
   1. Digital Tests and Hand-in exercises
   2. Online meetings (e.g. via ZOOM) student-student and teacher-student.
   3. Laboratories on the virtual classroom.
   4. Didactical materials online.

2. **Planned activities during physical component:**

It will combine theoretical lectures and student presentations. Several professors will be available for student questions.

Application procedure

ESTUDIANTES DE LA UNIVERSIDAD DE ZARAGOZA
N° de ayudas: 3
Requisitos:
*Estudiantes de la Universidad de Zaragoza matriculados en el curso 2023-2024 en estudios oficiales del grado en Matemáticas -3° ó 4°- o de los programas conjuntos Física-Matemáticas y Matemáticas-Ingeniería Informática 3°, 4° ó 5°-
En todos los casos, es imprescindible estar matriculados en estudios oficiales en el curso de solicitud -2023/2024- y en el curso de realización -2024/2025-
*Conocimiento de inglés de nivel B1.
Solicitud:
Disponible desde la URL: https://sede.unizar.es a través del Servicio “Gestión de solicitudes (SOLICIT@)”
Seleccionar en el menú “Opciones” > “Iniciar Nueva Solicitud”
Identificarse con NIP + contraseña administrativa
En la opción “Catálogo de solicitudes clasificadas por categorías”, elegir “Estudiantes de Grado, Máster, Doctorado, etc”.
Seleccionar el formulario “Programas Intensivos Combinados –BIP-“

Documentación a aportar :
Acreditación de conocimiento de inglés de nivel B1 de acuerdo con los reconocimientos que se señalan en la base 4.3 de la convocatoria.
Los nacionales de países ajenos al Espacio Europeo de Educación Superior, acreditación de estar en posesión de un permiso válido para residir en España durante el período de realización de la movilidad.

Plazo de solicitud: hasta el 7 de mayo de 2024