”Dunarea de Jos” University of Galati

Scientific Conference of Doctoral Schools

Perspectives and challenges in doctoral Research

14th Edition of SCDS-UDJG

11th and 12th of June 2026

BOOK OF ABSTRACTS

UNIVERSITAS GALATIENSIS

”Dunarea de Jos” University of Galati

DOCTORAL SCHOOL OF MECHANICAL AND INDUSTRIAL ENGINEERING
DOCTORAL SCHOOL OF FUNDAMENTAL SCIENCES AND ENGINEERING
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ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

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CONFERENCE PROGRAMME

THURSDAY – June 11, 2026

08:00-10:00	Invited plenary lectures
09:00-11:00	Participants registration
10:00-13:00	Invited lectures Oral presentations in concurrent sections
13:00-14:00	Lunch (building D - 1st floor)
14:00-16:00	Oral presentations in concurrent sections
16:00-16:30	Coffee break (building D - 1st floor)
16:00-19:00	Oral presentations in concurrent sections

FRIDAY – June 12, 2026

09:00-10:30	Oral presentations in concurrent sections
10:30-11:00	Coffee break (building D - 1st floor)
11:00-13:00	Posters session
11:00-13:00	Workshop
13:00-14:00	Awarding ceremony. Closing ceremony
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OP2.1

MODELING THE VOLUME OF MUNICIPAL WASTE DEPOSITED BY TECUCI MUNICIPALITY AND ASSESSING ITS IMPACT ON THE DESIGNED CAPACITY OF THE VALEA MĂRULUI MUNICIPAL WASTE LANDFILL

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ABSTRACT

This paper presents the modelling of the volume of municipal waste deposited by the administrative-territorial unit of Tecuci at the Valea Marului waste landfill, within the integrated waste management system of Galati County. The analysis is based on operational data recorded between 2020 and 2026, reflecting both the average quantities deposited and their seasonal variability. A projection model was developed to estimate the total volume of waste that could be disposed of over a 30-year period, assuming the continuation of current trends.

The study considers a conservative scenario based on reduced compaction conditions in order to assess the maximum potential volume occupied in the landfill. The results indicate that the cumulative contribution of UAT Tecuci could reach approximately 400,000 m³, representing a significant share of the total designed capacity of the landfill. This finding shows the pressure exerted by urban waste generators on the available storage capacity and the importance of implementing effective waste reduction and diversion measures. Such analyses are essential for improving long-term planning and ensuring the sustainability of waste management infrastructure.

Key words: municipal waste, landfill capacity, waste modelling, Tecuci, Valea Marului.

OP2.2

COEFFICIENT OF VARIATION ANALYSIS: A METHOD TO IDENTIFY AGGRESSIVE BEHAVIOR BASED ON IMU SIGNALS

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ABSTRACT

This paper aims to identify and validate a set of features relevant for detecting aggressive driving using natural data from two public datasets, Mendeley and Kaggle. The feature analysis follows two stages. The first stage involves segmenting accelerometer (Acc X, Acc Y, Acc Z) and gyroscope (gyro_x, gyro_y, gyro_z) signals using a sliding window of 300 samples with a step size of 100 samples. In the second stage, statistical features and dynamic jerk-based features are computed for each window across all three axes. A feature vector containing amplitude, coef_var, jerk_amplitude, jerk_max, jerk_mean, jerk_min, jerk_spikes, jerk_std, jerk_variance, kurtosis, skewness, std, std_error, and variance is built. The coefficient of variation (CV), computed across normal and aggressive driving classes, and the difference CV (ΔCV) between these values are computed as measures of separation between normal and aggressive behavior. Following the established procedure, the relevance of each feature was assessed. The features were grouped and compared by type, such as jerk versus statistical, and by sensor type, like accelerometer versus gyroscope. The results highlight that jerk-based features achieve significantly higher ΔCV values (over 90 on Kaggle and over 100 on Mendeley) than statistical features. These findings confirm the ability of jerk features to better distinguish between driving styles

Key words: IMU data; Jerk features; Statistical features; Coefficient of variation, difference between classes.

OP2.3

COMPARATIVE ANALYSIS OF CNN MODELS FOR FOREST FIRE DETECTION

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ABSTRACT

This study aims to compare the performance and efficiency of pre-trained CNN models (MobileNetV3, DenseNet121, InceptionV3, ConvNeXt) for forest fire detection and analysis. The synergy between model architecture and data preprocessing determines classification performance. A publicly available dataset, namely the Dataset for Forest Fire Detection (Mendeley Data), containing RGB images, is used to identify fire and non-fire scenarios. The image dataset is labeled and divided into two classes: fire and non-fire. Data augmentation techniques, including rotation, flipping, and zooming, are applied to enhance the training dataset and improve model generalization. To evaluate model performance, standard metrics such as accuracy, precision, recall, and F1-score are computed. Based on the quantitative comparative analysis, the InceptionV3 model achieves the highest performance (98% accuracy), followed by DenseNet121 (94% accuracy). Conversely, the ConvNeXt model has moderate performance (79% accuracy), whereas MobileNetV3 shows lower performance (69% accuracy). These findings reveal differences in feature extraction and model complexity, demonstrating that both architecture and data preprocessing significantly impact classification performance. This comparative analysis provides practical guidance for selecting appropriate models in different forest fire detection scenarios.

Key words: forest fire detection, deep learning models, transfer learning, data augmentation, image classification.

OP2.4

FROM PIXEL TO DIAGNOSIS: VISION TRANSFORMERS AND FOUNDATION MODELS IN MEDICAL IMAGE SEGMENTATION AND ANALYSIS

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ABSTRACT

The rapid advancement of artificial intelligence has fundamentally transformed the landscape of medical image analysis. While Convolutional Neural Networks (CNNs) have long dominated this field, their inherent limitations in capturing long-range spatial dependencies and generalizing across diverse imaging modalities have prompted the exploration of more expressive architectures. The emergence of Vision Transformers (ViT) and large-scale foundation models represents a paradigm shift, offering unprecedented capabilities in feature extraction, contextual understanding, and cross-domain transferability. This paper presents a comprehensive review of state-of-the-art transformer-based architectures and foundation models applied to medical image segmentation and analysis, with emphasis on self-attention mechanisms, zero-shot generalization, and clinical applicability. Key architectures examined include Swin Transformer, TransUNet, and Swin-UNet used for segmentation tasks, alongside foundation models such as the Segment Anything Model (SAM), MedSAM, and BiomedCLIP. Experimental evaluations conducted on benchmark datasets, including BraTS, DRIVE, and CheXpert, demonstrate that transformer-based models consistently outperform CNN baselines for tasks requiring global contextual reasoning. Transformers achieve superior Dice Similarity coefficients, IoU scores, and AUC-ROC values. MedSAM model exhibited robust zero-shot segmentation across MRI, CT, and histopathology modalities, while BiomedCLIP enabled effective cross-modal alignment between radiological images and clinical text. Despite their strong performance, challenges remain regarding computational cost, data efficiency, and clinical interpretability. Parameter-efficient fine-tuning strategies such as LoRA and federated learning frameworks are discussed as promising directions for real-world deployment. This work underscores the transformative potential of foundation models in shifting medical imaging from pixel-level processing toward context-aware, clinician-assistive diagnostic intelligence.

Key words: Vision Transformer, Swin Transformer, Foundation Models, Segment Anything Model, Medical Image Segmentation, Attention Mechanisms, MedSAM, BiomedCLIP, Clinical AI.

2.POSTERS

SECTION II: ADVANCED INVESTIGATION METHODS IN ENVIRONMENT AND BIOHEALTH

PP2.1

COMBINED SEM-EDX, XRF AND XRD TECHNIQUES USED IN ENVIRONMENTAL AND GEOCHEMICAL STUDIES AND CHARACTERIZATION OF ADVANCED MATERIALS

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ABSTRACT

Scanning electron microscopy (SEM) combined with energy dispersive X-ray analysis (EDX) technique represents a powerful analytical tool widely applied in environmental, geochemical, and advanced materials research. This study highlights the applicability of SEM-EDX to characterize powdered samples, including industrial soils, cultivated plants, marine sediments, fish, algae-based biocomposites, iron ores, boron nitride (BN) and synthetic diamonds. The investigations aimed to identify morphological features and semi-quantitative composition, providing insights into natural sedimentary processes, environmental pollution and materials' performance. While SEM images of various materials matrices revealed heterogeneity of particle morphology, phase distribution, irregularity of grain shapes and size variability, the EDX spectra confirmed either the purity of synthetic materials (BN, diamonds) or the presence of major and trace elements associated with environmental contamination (soils, sediments, fish, plants), bioaccumulation processes (algae, plant tissues) or natural mineral assemblages (ores). The obtained results demonstrate the versatility of SEM-EDX technique for correlating microstructural features with elemental composition, contributing to environmental assessment, resource evaluation, and the development of advanced materials. It can be combined with X-ray fluorescence (XRF) and X-ray diffraction (XRD) techniques for in-depth investigations of materials' microcomposition and microstructure.

Key words: SEM-EDX, morphological patterns, mineral phase, pollution, performance, trace elements.

Acknowledgment: The work was performed in the frame of the JINR-Romania programme, FLNP JINR Theme no. 03-4-1128-2017/2022, Internal research grant GI 7949/31.03.2025, and sustainability activities of EU-funded project BSB27 (MONITOX), JOP Black Sea Basin 2014–2020.

PP2.2

OPTICAL TRANSMISSION AND REFLECTION SPECTRA OF TIN OXIDE THIN FILMS

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ABSTRACT

Tin oxide thin films were deposited at room temperature by thermal evaporation in vacuum. Optical transmission and reflection spectra were recorded in the wavelength range 190-1100 nm. From these spectra the absorption coefficient, the extinction coefficient and the refractive index of the tin oxide thin films were calculated. The optical band gap energy of the tin oxide thin films was also determined.

Key words: thin films, tin oxide, optical constants, optical band gap energy.

PP2.3

COMPARATIVE SPECTRAL RESPONSE OF TREE LEAVES TO THERMOHYGROMETRIC STRESS OF THE ATMOSPHERE

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ABSTRACT

Urban trees are increasingly exposed to climatic stress due to thermohygrometric conditions. This study investigates the spectral response of three leaf types across four urban locations over a year. Leaf reflectance spectra were measured in the 190–1100 nm range using a spectrometer. Simultaneously, air temperature and relative humidity were recorded to characterize atmospheric conditions and to calculate vapor pressure deficit (VPD) as an indicator of the atmosphere. Spectral vegetation indices and chlorophyll-related indices were derived from the reflectance data. Differences among species and locations were analyzed using statistical methods. The results revealed significant variations in spectral signatures and vegetation indices among species and locations. Higher VPD values were generally associated with reduced spectral vegetation indices, indicating increased physiological stress. These results show that combining hyperspectral leaf reflectance with basic meteorological data is a non-destructive method for assessing atmospheric stress in urban trees.

Key words: climate stress, hyperspectral reflectance urban trees, spectral vegetation indices, VPI.

PP2.4

MICROBIAL IDENTIFICATION AND MATHEMATICAL MODELLING FOR OPTIMIZING THE REMEDIATION OF PETROLEUM-CONTAMINATED SOILS

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ABSTRACT

Petroleum-contaminated soil remains a major challenge for industrial sites, requiring remediation strategies that are both efficient and sustainable. Previous experimental work demonstrated that sewage sludge enhances hydrocarbon degradation by improving nutrient availability and stimulating indigenous microbial activity. Building on these findings, the present study introduces two key advances that deepen the mechanistic understanding of the process: the identification of hydrocarbon-degrading bacteria naturally present in sewage sludge and the development of a mathematical model describing the bioremediation dynamics. Three bacterial strains with confirmed hydrocarbon-oxidizing capacity were isolated and taxonomically identified, providing direct evidence that sewage sludge contributes a native microbial component that supports and accelerates the degradation process. To quantitatively describe system behavior, a coupled mathematical model was formulated to represent the evolution of bacterial and fungal populations and the depletion of total petroleum hydrocarbons (TPH). Numerical simulations using a fourth-order Runge–Kutta method reproduced experimental trends with high accuracy, highlighting the influence of sludge proportion and microbial interactions on degradation kinetics. These mathematical and microbial advances support the optimization of petroleum-industry soil remediation by linking experimental observations with mechanistic understanding. The integrated approach strengthens the scientific basis for transforming sewage sludge into a valuable resource within circular-economy remediation strategies.

Key words: bioremediation, petroleum-industry soils, sewage sludge, biodegrading microorganisms, mathematical modeling, circular economy.

PP2.5

A CONCEPTUAL DESIGN OF WOOL-BASED DETACHABLE FILTRATION LAYERS IN NATURE-BASED CONSTRUCTED WETLANDS

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ABSTRACT

Microplastics and other emerging pollutants are increasingly found in aquatic environments, while conventional wastewater treatment plants show limited removal efficiency. Nature-Based Solutions (NbS), such as constructed wetlands, provide sustainable alternatives.

This study proposes a conceptual design integrating a detachable wool-based fibrous layer within constructed wetlands. The layer provides physical filtration, supports microbial biofilm development, and enhances the retention of fine particles, including microplastics.

Its detachable configuration enables easy maintenance and improves system flexibility, highlighting the potential of natural fibrous materials in advanced wastewater treatment.

Key words: Constructed wetlands; Nature-Based Solutions (NbS); wool-based substrate; detachable filtration layer; microplastics; emerging pollutants; wastewater treatment; biofilm support.

PP2.6

OPTIMIZATION OF ANALYTICAL MODELS THAT DESCRIBE THE EVOLUTION OF THE CONCENTRATION OF HYDROCARBON DEGRADING BACTERIA FOR THE IMPLEMENTATION OF APPLICATIVE SOLUTIONS

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ABSTRACT

Currently, the optimization of applicative solutions represents a major topical issue. The command is primarily required by the requirement of the lowest possible energy consumption and obtaining maximum results.

From this point of view, the present work presents two complementary approaches. Deeper approaches are made and analytical models are built based on previous results and the results obtained are validated by numerical methods of recurrent integration with variable step. Numerical integration methods of the Runge-Kutta 2 and Runge-Kutta 4 type, respectively, for such processes are quite difficult to implement. We present such an implementation made in MATLAB.

Key words: biodegrading microorganisms, mathematical modeling, circular economy, bioremediation.

PP2.7

IMPLEMENTATION OF AN ALGORITHM FOR OPTIMIZING THE SELECTIVE WASTE COLLECTION PROCESS, USING RECURSIVE BACK-TRACKING ALGORITHM

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ABSTRACT

The selective waste collection process represents a major contemporary commitment. All states in the European Union have requested that household and industrial waste be recyclable. Thus, it has been requested that the share of waste that cannot be recycled and reused be reduced to a minimum by 2040. In this context, many local authorities have implemented various selective household waste collection programs in order to optimize processing costs and increase processing efficiency.

In this regard, the present study takes a data set that describes the selective household waste collection process and proposes a lifting and transportation algorithm for a significant reduction in material costs. This approach is in line with the current issues of the global energy market, and is based on the use of Dijkstra-type algorithms in the multidimensional case, in a recurrent way.

Key words: biodegrading microorganisms, mathematical modeling, circular economy, bioremediation.

PP2.8

AQUATIC MACROINVERTEBRATES AS VECTORS OF HEAVY METAL TRANSFER BETWEEN AQUATIC AND TERRESTRIAL ECOSYSTEMS IN THE DANUBE DELTA

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ABSTRACT

This study examines the role of aquatic macroinvertebrates in the transfer of heavy metals from aquatic habitats to adjacent terrestrial ecosystems in the Danube Delta. The research was carried out in selected wetland habitats, including the Enisala–Razim canal, Lake Parcheș, Lake Zaghen and the Somova–Parcheș canal. Water samples and macroinvertebrates were collected from littoral zones, and metal concentrations for arsenic, cadmium, chromium, copper, lead and nickel were determined using ICP-MS.

The biological samples were collected from different aquatic organisms namely mollusks, chironomids, odonates and the invasive freshwater decapod Macrobrachium nipponense. Particular attention was given to chironomids because of their ecological importance modulated by high abundance, short life cycle and synchronized emergence. In the Enisala–Razim canal, 1,443 chironomid individuals belonging to 28 species were collected between April and August 2025 and the most abundant species were Polypedilum nubeculosum, Dicrotendipes nervosus and Glyptotendipes pallens. Metal accumulation in muscle tissue varied both among the mollusk species analyzed and among the different collection sites. The filter-feeding lamellibranches Unio pictorum recorded the highest concentrations of arsenic, cadmium, and zinc, while the gastropod species Viviparus acerosus accumulated the most copper and nickel. These differences were influenced by the different feeding habits and microhabitats specific to each organism.

Analysis of the bioaccumulation factor revealed clear differences between metals as well as between types of aquatic organisms. Insects, represented in our study by chironomids and odonates, particularly those sampled at Enisala, have higher bioaccumulation factor values for zinc and copper. The results suggest that aquatic insect larvae, after metamorphosis into adults, contribute to the transfer of heavy metals from the aquatic environment specific to the larvae to the terrestrial environment specific to the adults. This transfer is all the more relevant given that insects serve as a food source for other organisms higher up the food chain, thereby contributing to the dispersal of these metals to spiders, bats, or birds.

The study is significant in that it highlights and demonstrates the role of aquatic macroinvertebrates not only as bioindicators of heavy metal contamination but also as vectors through which these contaminants can be transferred from aquatic to terrestrial ecosystems.

Key words: heavy metals; aquatic macroinvertebrates; bioaccumulation; aquatic-terrestrial transfer.

PP2.9

ASSESSMENT OF POTENTIALLY TOXIC ELEMENTS RISK IN URBAN SOILS FROM EDUCATIONAL AND RECREATIONAL AREAS USING XRF SPECTROMETRY

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ABSTRACT

In recent years, high concentrations of potentially toxic elements, including heavy metals, have been reported in urban soils, mainly due to human activities such as construction, intense traffic, industry, and the uncontrolled use of fertilizers. These metals, often present in dust particles, can be easily transported by wind or rain and may accumulate in soils, especially in areas lacking vegetation. Children are frequently playing in such environments, leading to their daily exposure to these pollutants and subsequently augmented health risk. For this study, a multielemental analysis was performed on urban soil samples using X-ray fluorescence (XRF) spectrometry. In the first campaign, the investigated areas included the municipalities of Galati and Bacau, Romania. In Galati, soil samples were collected from five representative parks. The second study area comprised Râmnicu Sarat city (Buzau County), where the soil quality was assessed in the yards of five schools. In both studies, samples were collected from the surface soil layer (0–10 cm), specifically from areas near park fences, with higher traffic exposure, as well as from playground areas. In both investigations, the highest levels of pollution were found in the areas most exposed to the traffic, while the lack of vegetation was also identified as a contributing factor to the enhanced contamination. A comparison between the toxic risk values obtained in the two studies was done.

Key words: soil quality, XRF, Galati, Bacau, Râmnicu Sarat, Romania.

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PP2.10

IMPLEMENTATION OF AN ALGORITHM FOR OPTIMIZING THE SELECTIVE WASTE COLLECTION PROCESS, USING PREDICTIVE AND DIJKSTRA-TYPE GRAPH TRAVERSAL METHODS

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ABSTRACT

The selective waste gathering procedure represents a major contemporary obligation. In this context, many local authorities have implemented various selective household waste collection programs in order to optimize processing costs and increase processing efficiency.

In the current context, for the use of the ecological islands installed within the municipality of Galati, and considering only 3 types of collectable waste, we were able to structure as sufficient elements: Input data containing - set of collection nodes C; requests per node: (hi, pi, si); fleet: K vehicles, each with capacities (Hmax, Pmax, Smax), road graph with distances as well as basic heuristics (greedy + Dijkstra) we were able to structure an optimization algorithm.

Key words: mathematical modeling, circular economy, bioremediation.

PP2.11

SATELLITE-BASED ASSESSMENT OF SOLAR RADIATION AND PHOTOVOLTAIC POTENTIAL IN ROMANIA

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ABSTRACT

In response to the environmental challenges worldwide, solar energy has become one of the most important renewable energy sources for reducing greenhouse gas emissions, for a clean air, and for supporting sustainable development. In recent decades, the photovoltaic panels and the solar thermal collector technologies have extended due to technological improvements, decreasing installation costs, and climate policies. Still, the performance of solar energy systems strongly depends on solar activity, cloud cover, greenhouse gas and aerosol concentrations. The contribution of all these factors to the solar energy harvesting can be assessed by means of the solar energy fluxes, both as total radiation, but also separately, as longwave and shortwave radiation, respectively, which account for the atmospheric energy exchanges and provide a strong base for assessing the solar energy generation potential.

This paper presents an analysis of Romania's solar energy potential by using satellite-derived radiative fluxes from the NASA CERES (Clouds and the Earth's Radiant Energy System) EBAF-TOA dataset, focusing on key atmospheric radiation parameters: the Incoming Solar Flux, the Top of the Atmosphere outgoing Longwave and shortwave Fluxes, and the Top of the Atmosphere Net Flux. The data correspond to the 2000-2025 period.

Key words: solar radiation, photovoltaic potential, CERES, Romania.

PP2.12

A COMPARATIVE NUMERICAL STUDY FOR SOLVING THE PARABOLIC PARTIAL DIFFERENTIAL EQUATION

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ABSTRACT

In this paper, we comparatively present the results obtained by two implicit methods in solving the parabolic partial differential equation. The methods considered are the Backward Euler method and the Crank – Nicolson method. Following the application of the two implicit methods, systems of linear equations are obtained whose associated matrix has the tridiagonal form. The Thomas algorithm will be used to solve these systems of linear equations. In conclusion, the two methods analyzed are useful in solving parabolic problems.

Key words: Backward Euler method, Crank – Nicolson method, Thomas algorithm.