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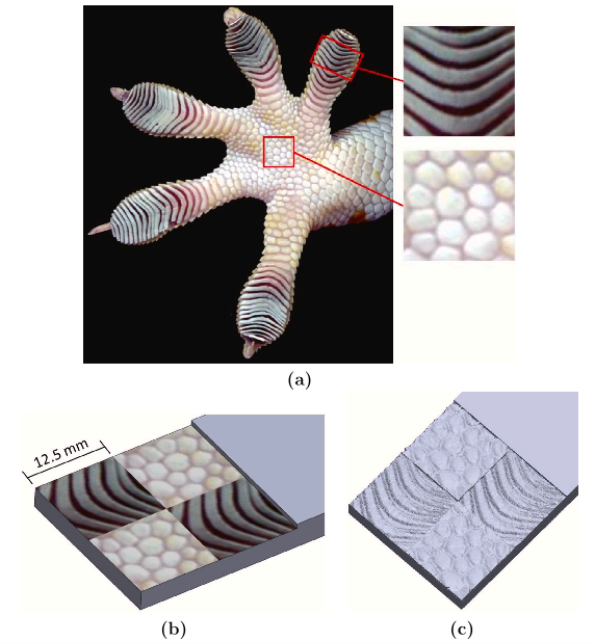
Research Bulletin

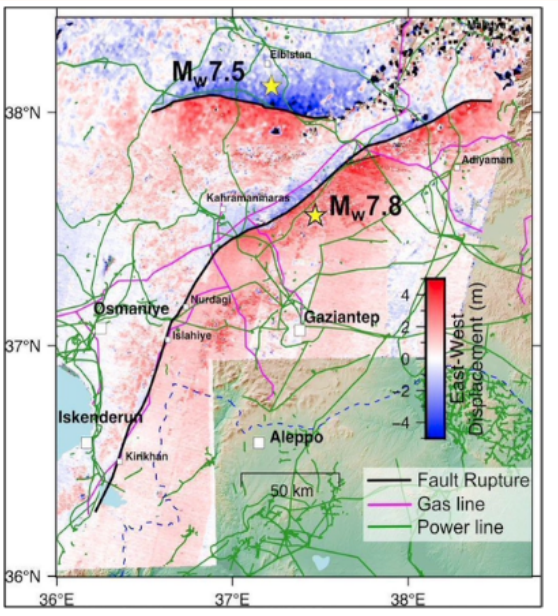
March 2025

IMPROVED BONDING STRENGTH WITH LIZARD FOOT-INSPIRED SURFACES

Surface patterns inspired by the lizard's foot were used to increase the strength of the bonded metal parts. These specialised surfaces provided improved adhesion and load-bearing capacity at the joints. Three different artificially created surface patterns offered a strength increase of up to 118 per cent compared with a conventional surface. The method was observed to increase mechanical interlocking, making the joints more robust.



Atahan, M. G., Maskery, I., Ashcroft, I., Apalak, M. K., & Pappas, A. (2025). Effect of bio-mimicked surface texturing on the shear strength of additively manufactured metal single-lap joints: an innovative approach. Engineering Failure Analysis, 174, 109460. https://doi.org/10.1016/j.engfailanal.2025.109460



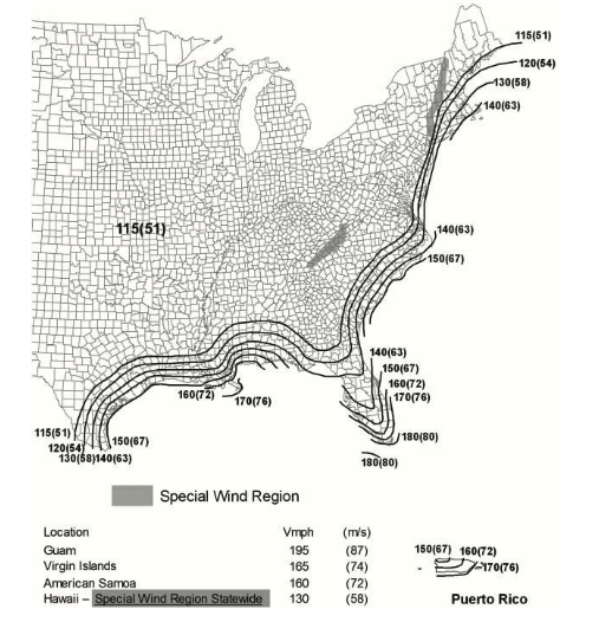
POST-EARTHQUAKE RESPONSE AND SOCIAL IMPACTS THOROUGHLY EVALUATED

The emergency response process and societal impacts following the earthquakes centered in Kahramanmaraş on February 6, 2023, were examined in detail. The study analyzed developments in search and rescue, healthcare services, shelter, and psychosocial support within the first 24 hours, 3 days, and 2 weeks after the disaster. Findings revealed the need to strengthen preparedness strategies for future disasters.

Balaban, M. Ş., Doğulu, C., Akdede, N., Akoğlu, H., Karakayalı, O., Yılmaz, S., Yılmaz, S., Ajobiewe, T., Güzel, S., İkizer, G., Akin, M., Ünal, Y. & Karancı, A. N. (2024). Emergency response, and community impact after february 6, 2023 kahramanmaraş pazarcık and elbistan earthquakes: reconnaissance findings and observations on affected region in türkiye. Bulletin of Earthquake Engineering, 23(3), 1053-1081. https://doi.org/10.1007/s10518-024-01867-3

STEEL STRUCTURES TESTED AGAINST STORMS: BRACED SYSTEMS LEAD IN DURABILITY

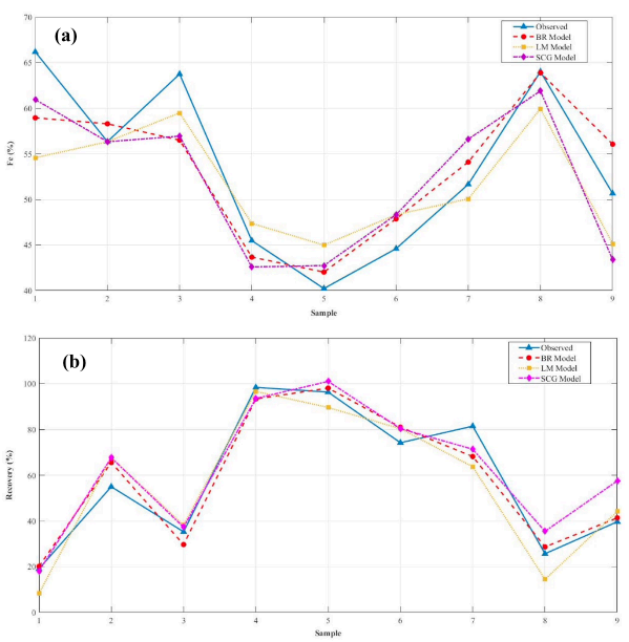
The resistance of various steel structural systems to wind loads was examined through computer-aided simulations. The study compared moment-resisting frame systems with braced frame systems. Analyses revealed that braced systems could withstand nearly twice the wind speed compared to moment-resisting systems. However, implementing this system required nearly twice as much steel material. The findings offer valuable insights for designing safer and more resilient structures in an era of increasing wind-related natural disasters.



Özalp, A. A., Gökdemir, H., & Çiftçi, C. (2025). The comparison of fragility curves of moment-resisting and braced frames used in steel structures under varying wind load. Turkish Journal of Civil Engineering, 36(2), 1-27. https://doi.org/10.18400/tjce.1211905

HIGH-QUALITY PRODUCT OBTAINED FROM LOW-GRADE IRON ORE USING AI-SUPPORTED METHOD

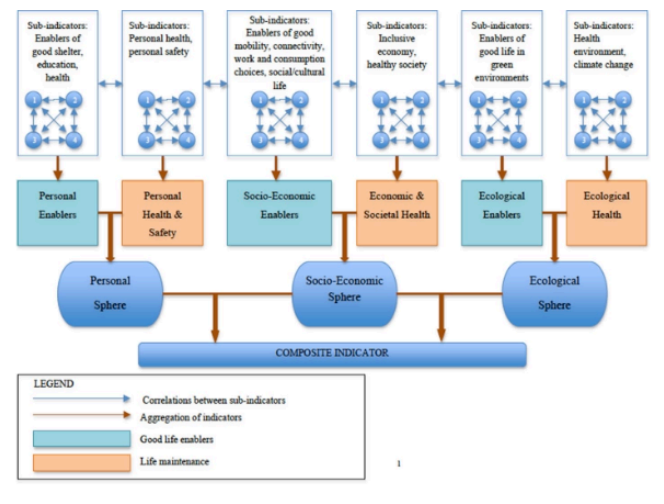
Low-grade iron ore extracted from the Adana/Feke region was processed using a dry magnetic separation method. During the experiments, variables such as particle size, magnetic field strength, and belt speed were altered, resulting in an iron concentration of up to 67.6%. However, in cases where such high purity was achieved, the recovery rate fell below 14%. The collected data was analyzed using artificial intelligence models, with the most accurate predictions made by the Bayesian Regularization method, which effectively handles uncertainties.



Fariss, A. H. B., Ibrahim, A. I. I., Ozdemir, A. C., Top, S., Kursunoglu, S., & Altiner, M. (2025). Beneficiation of low-grade iron ore using a dry-roll magnetic separator and its modeling via artificial neural network. Journal of Sustainable Metallurgy. https://doi.org/10.1007/s40831-025-01030-5

QUALITY OF LIFE ASSESSED IN EUROPE: MOST ACCURATE RESULTS ACHIEVED WITH ENTROPY METHOD

The quality of life across European regions was evaluated using an index that combined social, economic, and environmental indicators. Based on data from 223 regions, 30 key indicators were identified and analyzed using various calculation methods. Among these, the "entropy weighting" method was found to produce the most stable and reliable results. The study aims to contribute to creating more livable urban environments and to support decision-makers with more robust data.



Ustaoğlu, E., Lopez, G. O., & Gutierrez-Alcoba, A. (2023). Building composite indicators for the territorial quality of life assessment in european regions: combining data reduction and alternative weighting techniques. Environment, Development and Sustainability, 27(3), 6025-6063. https://doi.org/10.1007/s10668-023-04116-w

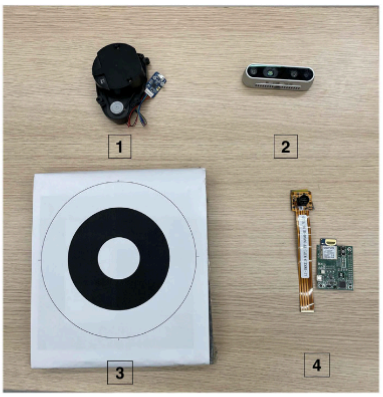


Figure 21. *The Comparison and applications: a) The sensors and methods used in the comparison: 1-LDS Lidar, 2-Intel RealSense Depth Camera D435i, 3-A whycon circular marker 4 -Ours: A camera and UWB.*

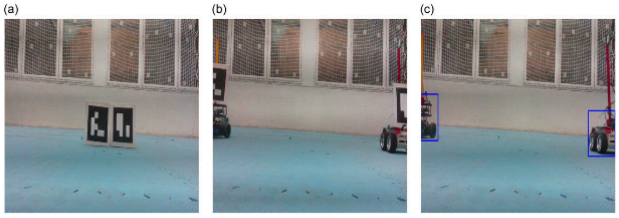


Figure 22. *Comparison of our detection against Aruco marker: a) Two Aruco markers, b) The result from Aruco-based approach. C) The detection from a convolutional neural networks-based approach.*

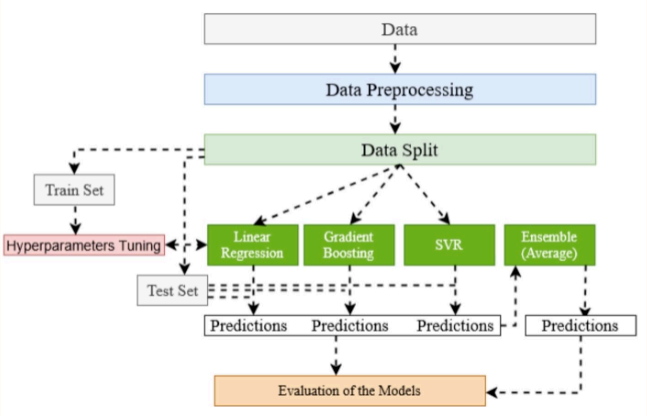
A NEW SYSTEM DEVELOPED FOR SYNCHRONIZED MOVEMENT AMONG ROBOTS

A new method has been developed to enable a group of ground robots to move together in a coordinated manner without relying on external positioning systems. In this system, robots detect each other's positions using only onboard cameras and distance-measuring sensors, allowing them to move collectively. The method was tested successfully in both simulations and real-world environments. This advancement enables robots to operate in a synchronized fashion in settings such as factories, agricultural fields, or disaster zones.

Kabore, K. M. and Güler, S. (2025). Efficient relative localization and coordination system for unmanned ground vehicle formations under directed graph structure. Robotica, 1-23. https://doi.org/10.1017/s026357472500013x

ACCESS TO CLEAN ENERGY BY 2030: CHALLENGES IN DEVELOPING COUNTRIES

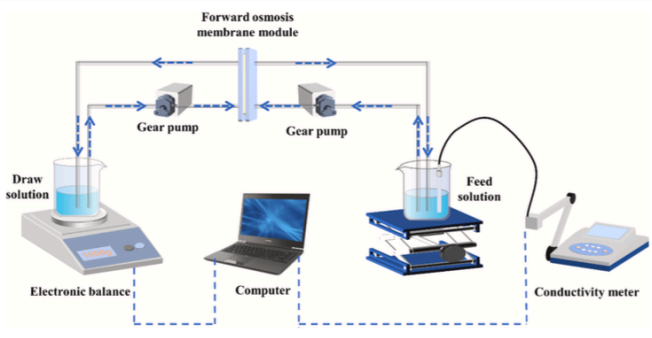
The future of access to clean cooking energy in developing countries was evaluated using AI-supported prediction methods. The study, focusing on BRICS, MINT, ASEAN, and MENA countries, projected that only a few nations would achieve 100% clean energy access by 2030. For instance, India is expected to meet the target, while countries like Russia and Nigeria are predicted to face setbacks. The use of machine learning techniques in the study provided more accurate forecasts for energy planning.



Cakir, M. A., Unlu, R., Cakir, S. C., & Xanthopoulos, P. (2025). Future of clean cooking energy access in emerging economies by 2030. Operations Research Forum, 6(1). https://doi.org/10.1007/s43069-025-00431-2

NEXT-GENERATION WATER PURIFICATION MEMBRANE DEVELOPED FOR HARSH ENVIRONMENTS

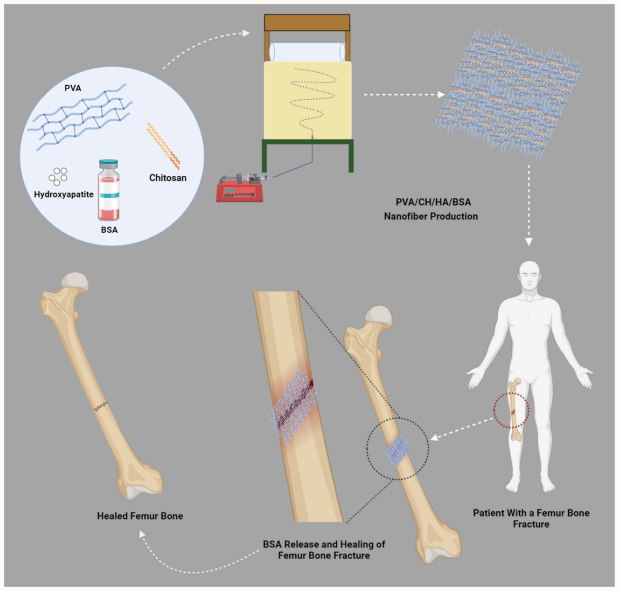
A water purification membrane resistant to high temperatures and chemical exposure has been developed. The surface of this advanced PTFE-based membrane was coated with a surfactant called DTAB, allowing for greater water permeability and reduced salt passage. Tests revealed that the membrane maintained its performance even under acidic and basic conditions. After being exposed to a pH range of 1–13 for 60 days, the membrane successfully removed 99.9% of chromium and 96% of organic matter from water.



Ye, W., Meng, L., Wang, R., Yan, M., Yu, F., Bao, Y., Xing, H., Li, J., UZAL, N., Huang, M.& Huang, M. (2025). Surfactant modified ptfe-based forward osmosis membrane with high performance and superior stability. Separation and Purification Technology, 364, 132419. https://doi.org/10.1016/j.seppur.2025.132419

NEW HOPE FOR INJURED BONES: BONE REPAIR WITH BIOCOMPATIBLE FIBERS

The effects of a newly developed nanofiber structure for bone tissue repair were investigated. The study found that fibers composed of PVA, chitosan, and hydroxyapatite containing the volatile protein BSA were compatible with cells and enhanced the growth of bone cells. The fibers' biodegradability and protein release were also tested. The highest cell viability rate was observed in samples containing 0.15% BSA. These fibers are considered promising candidates for use in the treatment of bone fractures.



Bozdag, M., Urek, F., Cesur, S., Sahin, A., & Gunduz, O. (2025). Bovine Serum Albumin (BSA)-Loaded Polyvinyl alcohol (PVA)/Chitosan (CH)/Hydroxyapatite (HA) Electrospun Nanofibers For Bone Tissue Regeneration. Journal of Drug Delivery Science and Technology, 106712.

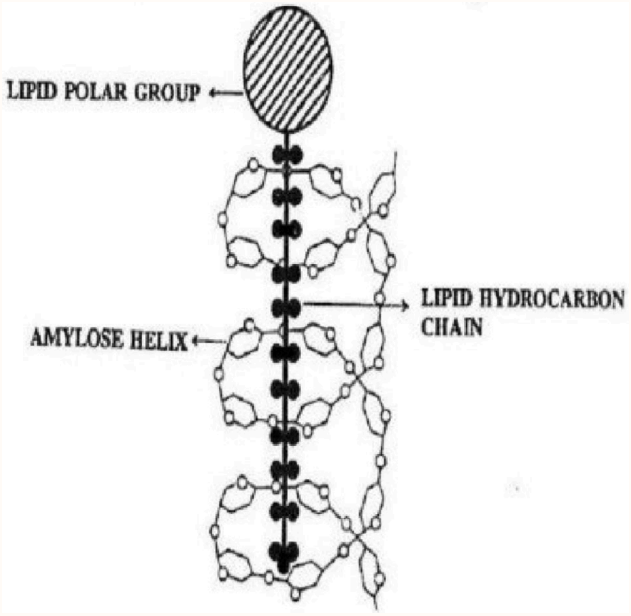
AN ALTERNATIVE TO TRADITIONAL CONCRETE: FLY ASH-BASED GEOPOLYMER CONCRETE PUT TO THE TEST

An experimental study was conducted to evaluate the usability of geopolymer concrete in load-bearing structures by investigating the validity of equivalent stress block parameters. Columns and beams made from fly ash-based geopolymer concrete were tested. The parameters were found to be consistent with existing building standards. Additionally, geopolymer concrete was observed to offer a higher reinforcement ratio compared to traditional concrete. These findings may contribute to the ongoing search for sustainable construction materials.

Özbayrak, A., & Kucukgoncu, H. (2025). Equivalent stress block parameters for fly ash-based geopolymer concrete structural elements. Structural Concrete.

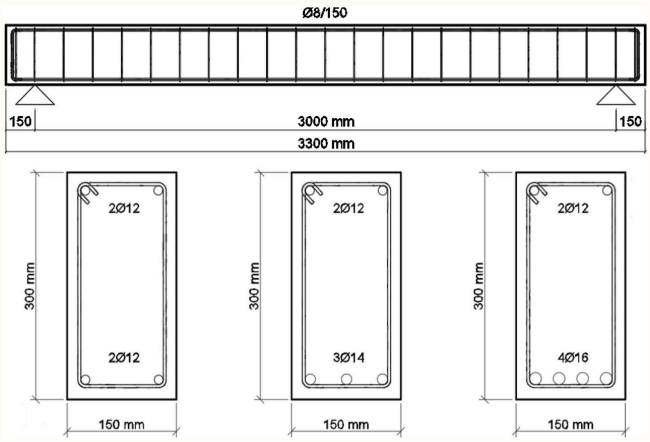
A NEW FILM DEVELOPED FOR EDIBLE PACKAGING

An edible film made from buckwheat starch and capric acid has been developed. Compared to traditional starch films, the new film demonstrated better water vapor barrier properties and lower water solubility. It was found to have increased flexibility, reduced thickness, and a hydrophilic surface. This study presents a promising approach for eco-friendly packaging solutions.



Koca, E., Kahraman, K., Oskaybaş-Emlek, B., Özbey, A., & Aydemir, L. Y. (2025). Development of Buckwheat Starch-Capric Acid Complex-Based Film: Process Optimization and Film Characterization. Starch-Stärke, e70001.

A NEW TYPE OF CONCRETE MAY ENABLE MORE DURABLE AND ECO-FRIENDLY STRUCTURES

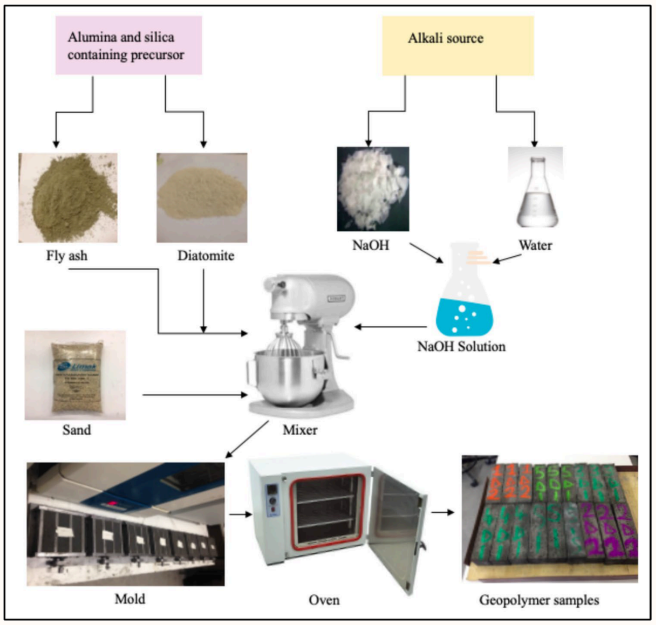


The performance of geopolymer concrete, known for its environmentally friendly properties, was investigated in reinforced concrete beams using both experimental and numerical methods. The effects of different curing methods and reinforcement ratios were tested and compared with traditional concrete. Geopolymer concrete showed promise for safer structures due to its higher deformation capacity and better local damage distribution. Numerical models were found to align closely with experimental data.

Özbayrak, A., Kucukgoncu, H., Aslanbay, H. H., & Aslanbay, Y. G. (2025). Stress and Damage Distribution Analysis of Steel Reinforced Geopolymer Concrete Beams: Finite Element Method and Experimental Comparison under Varying Design Parameters. Journal of Building Engineering, 112229.

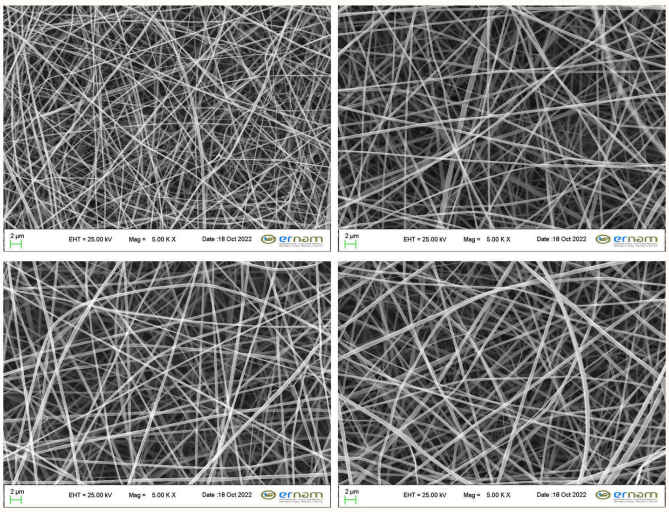
A STEP TOWARD A CLEANER FUTURE WITH ASH AND ALGAE

By combining fly ash, a waste product from thermal power plants, with naturally occurring diatomite, researchers developed an eco-friendly construction material. This new material was found to produce 25% less greenhouse gas emissions compared to traditional cement. The study highlighted that the most effective results were achieved with 2% diatomite, significantly reducing environmental impact.



Ilkentapar, S., Örklemez, E., Durak, U., Gülçimen, S., Bayram, S., Uzal, N., Uzal, B., Karahan, O. & Atis, C. D. (2025). Evaluation of diatomite substitute with thermal power plant waste fly ash in sustainable geopolymer through life cycle assessment. Journal of Material Cycles and Waste Management, 1-18.

GRAPE POMACE USED TO PRESERVE WALNUT FRESHNESS

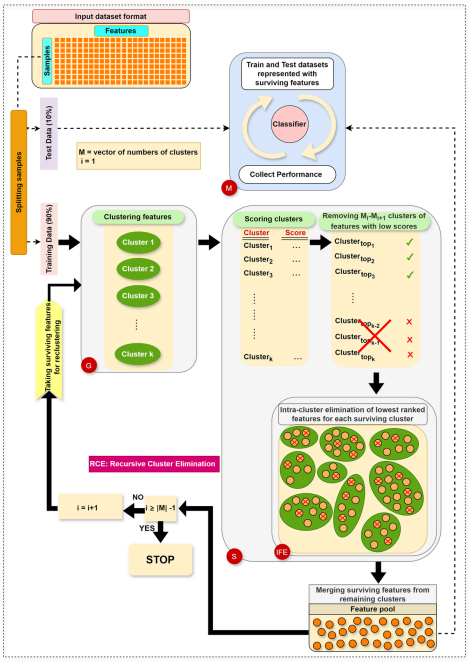


It has been shown that grape pomace, a by-product of the food industry, can be used to keep walnuts fresh. Nanofiber films developed with grape pomace extract were found to reduce oxidation in walnut packaging. Experiments conducted over three weeks revealed that films containing 20% extract provided the highest level of preservation. This innovative approach is believed to contribute to reducing food waste and promoting more efficient use of natural resources.

Yilmaz, B., Kahraman, K., & Ekici, L. (2024). Fabrication of Grape Pomace Extract–Loaded Electrospun Nanofiber Films as Active Packaging Material for Walnut. Food and Bioprocess Technology, 1-11.

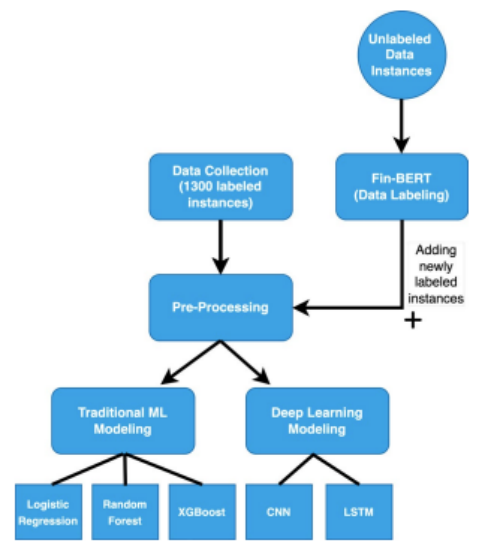
NEW METHOD SPEEDS UP AND ENHANCES DISEASE DETECTION

A new method called RCE-IFE, developed by researchers working on biological data, enables the identification of disease-related genes with less data and in a shorter amount of time. RCE-IFE demonstrated superior performance across multiple datasets, maintaining high accuracy while effectively eliminating irrelevant information. The method proved particularly effective in areas such as cancer, diabetes, and intestinal diseases.



Kuzudisli, C., Bakir-Gungor, B., Qaqish, B., & Yousef, M. (2025). RCE-IFE: recursive cluster elimination with intra-cluster feature elimination. PeerJ Computer Science, 11, e2528.

SENTIMENT ANALYSIS IN STOCK MARKET POSTS ENHANCED WITH BERT

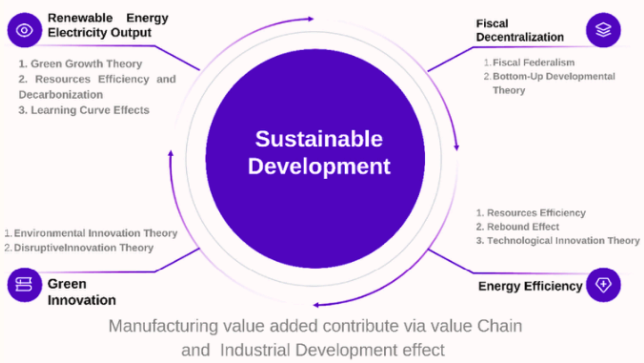


In a study aiming to perform sentiment analysis on stock market-related tweets, it was observed that using data labeled with the pre-trained FinBERT model led to a 17% to 20% increase in the performance of machine and deep learning models. The increase in data volume positively impacted performance, with the highest F1 score reaching 69%. This study presented a significant approach to addressing the challenge of limited labeled data.

Cicekyurt, E., & Bakal, G. (2025). Enhancing Sentiment Analysis in Stock Market Tweets Through BERT-Based Knowledge Transfer. Computational Economics, 1-23.

EMPHASIS WAS PLACED ON LOCAL GOVERNMENTS AND CLEAN ENERGY FOR SUSTAINABLE DEVELOPMENT IN OECD COUNTRIES

The factors affecting sustainable development in OECD countries were examined using data from 1995 to 2020. The study evaluated energy efficiency, the use of renewable energy, green innovation, and the fiscal authority of local governments. It was observed that granting local governments control over budgets and revenues made it easier to achieve environmental and economic goals.



Additionally, it was found that energy efficiency and industrial production enhanced sustainability. However, the impact of renewable energy and green innovation on development was identified as complex and fluctuating.

Binsaeed, R. H., Khan, Z., Dogan, E., & Rahim, S. (2025). The role of energy efficiency, renewable resources, green innovation, and fiscal decentralization in sustainable development: evidence from oecd countries. Utilities Policy, 95, 101915. https://doi.org/10.1016/j.jup.2025.101915

TURKEY'S DEFENSE INDUSTRY: AN EVALUATION OF THE INDEPENDENCE GOAL, PRODUCTION PROCESS, AND POLITICAL DISCOURSE

Turkey's goal of full independence in the defense industry was examined within the framework of financial and structural conditions. The increase in domestic production and ongoing dependency on foreign subcomponents were discussed. The political use of defense industry discourse was also evaluated, along with how such narratives influence the public discussion of structural challenges.

Kurç, Ç., Güvenç, S., Mevlütoğlu, A., & Egeli, S. (2025). Balancing aspiration and reality: autarky in Turkish defence industrial policy. Defence Studies, 1-24.

THE ERA OF ARTIFICIAL INTELLIGENCE IN FOREIGN LANGUAGE WRITING EDUCATION

Traditional feedback methods in foreign language writing instruction have been found to be insufficient. This study proposes that dialogic feedback systems supported by large language models can enhance student engagement and reduce teachers' workload. A new theoretical framework and an AI-powered writing tool have been developed, with plans to test their effectiveness through experimental sessions. The research will explore how AI-enhanced feedback influences students' writing skills and the interaction patterns within the feedback process.

Sökücü, G. (2025). Empowering Dialogic Feedback in FLW with LLM.

AN EXAMINATION OF DEFENSE INDUSTRY POLICIES IN SMALL AND MEDIUM-SIZED COUNTRIES

The defense industry policies of small and medium-sized countries were analyzed within the context of technological advancements and global competition. These nations' efforts to produce their own weapons were discussed alongside goals such as strategic autonomy, job creation, and reducing foreign dependency. The study also addressed challenges such as high costs, limited resources, and competition with major powers. Levels of domestic production and dependency on imports were comparatively examined across different countries.

Rossiter, A., Kurç, Ç., & Novella, M. (2025). Defence industry policies of small and medium powers: an introduction to the challenges and prospects. Defence Studies, 1-11. https://doi.org/10.1080/14702436.2025.2472723