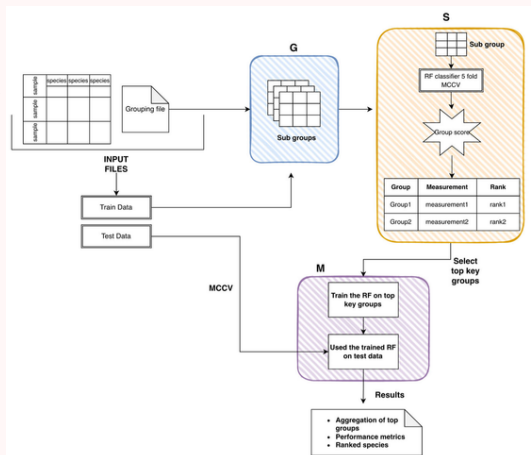


Research Bulletin

August 2026

AI-BASED IDENTIFICATION OF MICROBIOTA-BASED BIOMARKERS IN DIGESTIVE SYSTEM CANCERS

Microorganism profiles were investigated across five digestive system cancers: head and neck, esophageal, gastric, colon, and colorectal cancers. A machine learning model called MicrobiomeGSM, based on a taxonomic grouping strategy, was developed. Blood and tissue samples from the Cancer Microbiome Atlas database were comparatively analyzed, and colon cancer was identified with 97% discriminative performance using only 30 microbial species. The proposed approach was compared with six conventional feature selection methods. Both shared and cancer-specific candidate biomarkers were identified across the different cancer types. The findings may contribute to future applications in precision oncology.



Canakcimaksutoglu, B., Ersoz, N. S., Bakir-Gungor, B., & Yousef, M. (2026). Discovering potential taxonomic biomarkers of gastrointestinal cancers from various human microbiota via G-S-M machine learning approach. *Applied Sciences*, 16(14), 6879. <https://doi.org/10.3390/app16146879>

DIGITAL COMPETENCE IDENTIFIED AS A PROTECTIVE RESOURCE AGAINST BURNOUT AMONG UNIVERSITY INSTRUCTORS

A survey of 43 English instructors at two public universities examined self-efficacy, digital competence, and burnout. Higher digital competence was associated with lower burnout, while higher self-efficacy was linked to increased burnout. Together, these factors explained 36.6% of the variation in burnout. The unexpected relationship between self-efficacy and burnout may reflect increased role demands in technology-intensive environments. The study recommends digital professional development and effective workload management.

Variable	1	2	3
1. Self-Efficacy	1		
2. Digital Competence	.075	1	
3. Burnout	.422**	-.401**	1

Note. N = 43. Pearson correlations, two-tailed. ** p < .01.

Self-efficacy showed a medium positive association with burnout ($r = .422, p = .005$). Digital competence showed a medium negative association with burnout ($r = -.401, p = .008$). The association between self-efficacy and digital competence was trivial and non-significant ($r = .075, p = .631$). Tables 3, 4, and 5 present subscale-level correlations.

Variable	SE Total	Student Engagement	Instructional Strategies	Classroom Management
SE Total	1			
Student Engagement	.515**	1		
Instructional Strategies	.320*	-.033	1	
Classroom Management	.778**	.151	-.195	1

Note. N = 43. ** p < .01; * p < .05.

Variable	DC Total	ES	DSDC	MTLP	UDR	EPE	AEA
DC Total	1						
ES	.816**	1					
DSDC	.442**	.286	1				
MTLP	.854**	.754**	.098	1			
UDR	.806**	.406**	.280	.610**	1		
EPE	.409**	.739**	.045	.507**	-.077	1	
AEA	.730**	.394**	.007	.643**	.771**	-.080	1

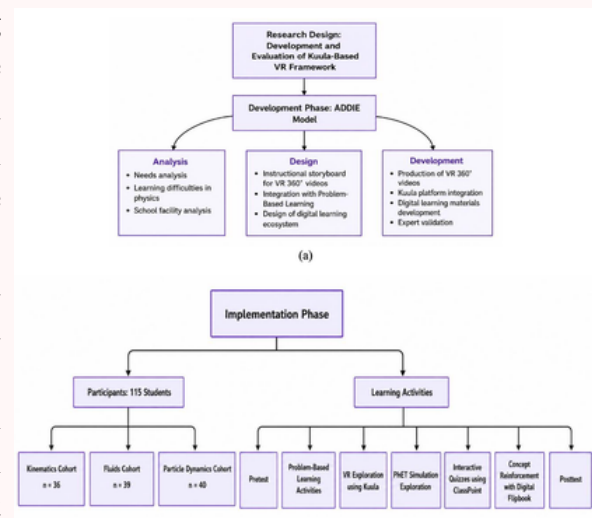
Note. N = 43. ** p < .01. ES = Empowering Students; DSDC = Developing Students' Digital Competence; MTLP = Managing Teaching-Learning Process; UDR = Using Digital Resources; EPE = Ensuring Professional Engagement; AEA = Ability to Evaluate and Assess.

Artut, E., & Duruk, E. (2026). Digital competence and burnout in technology-mediated higher education. *International Journal of Technology in Education and Science*, 10(4), 816–829. <https://doi.org/10.46328/ijtes.7951>

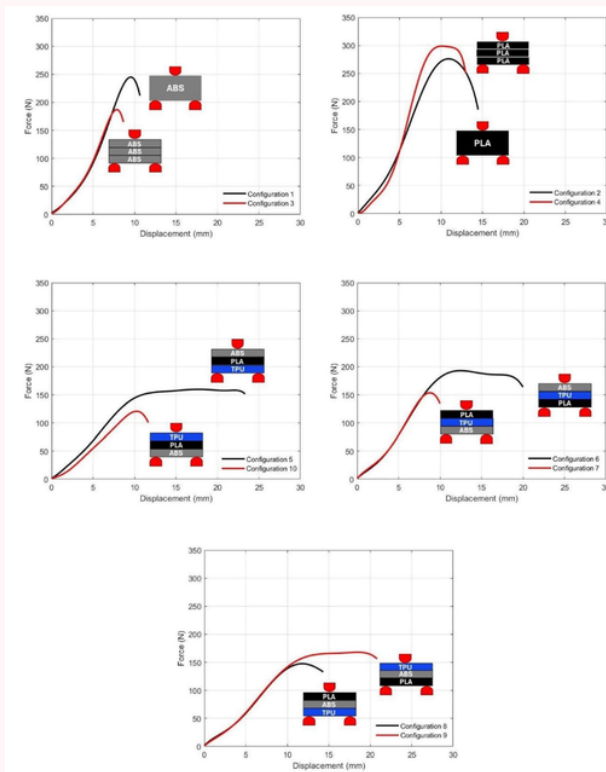


VR-BASED DIGITAL LEARNING ENVIRONMENT IMPROVES UNDERSTANDING OF PHYSICS CONCEPTS

An integrated learning framework combining 360-degree virtual reality videos with online classrooms, interactive quizzes, digital books, and simulations was developed to support high school students' understanding of physics concepts. The framework was implemented with 115 students across topics including kinematics, fluids, and particle dynamics. Expert evaluations showed high validity and usability, while students demonstrated significant improvement between pre- and post-test scores and substantial gains in conceptual understanding. The study noted that the findings were limited to a single school.



Risdianto, E., Santos, J., Lomerio, N., Dewi, D. A., Kuloglu, M. E., Alshammari, S. H., & Nurfitriani, R. (2026). Integrated virtual reality learning framework with digital ecosystem for enhancing physics conceptual understanding. *Journal of Educational Technology and Learning Creativity*, 4(1), 120–131. <https://doi.org/10.37251/jetlc.v4i1.2955>



3D-PRINTED LIGHTWEIGHT SANDWICH STRUCTURES DEVELOPED FOR UNMANNED AERIAL VEHICLES

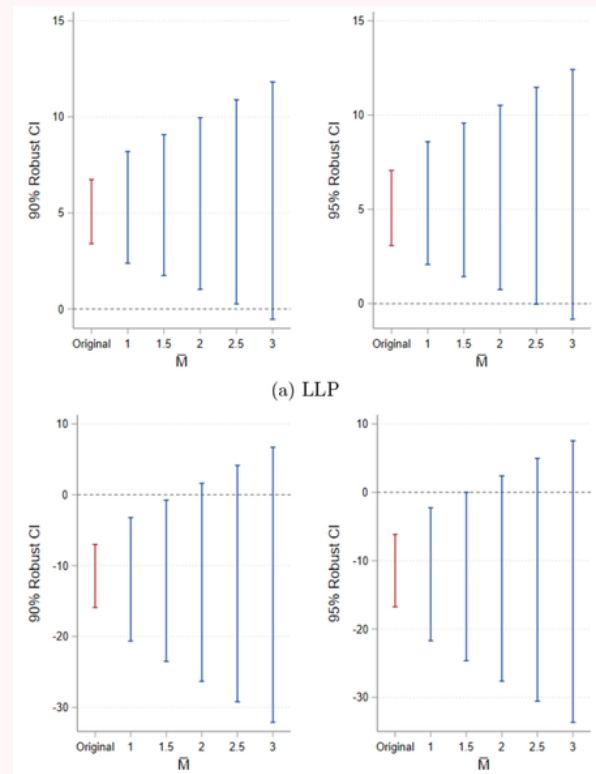
3D-printed honeycomb sandwich core structures were developed for use as load-bearing and energy-absorbing components in unmanned aerial vehicles. Ten different configurations combining various plastic materials were produced and evaluated using three-point bending tests. Flexible materials reduced load-bearing capacity but increased deformation capability. The best-performing configurations showed significantly higher energy absorption compared with single-material structures.

Atahan, M. G., Bulum, M. Z., & Apalak, M. K. (2026). Effect of material configuration on the bending behavior of 3D-printed adhesively bonded sandwich core structures. *Journal of the Brazilian Society of Mechanical Sciences and Engineering*, 48(11), 652. <https://doi.org/10.1007/s40430-026-06632-y>



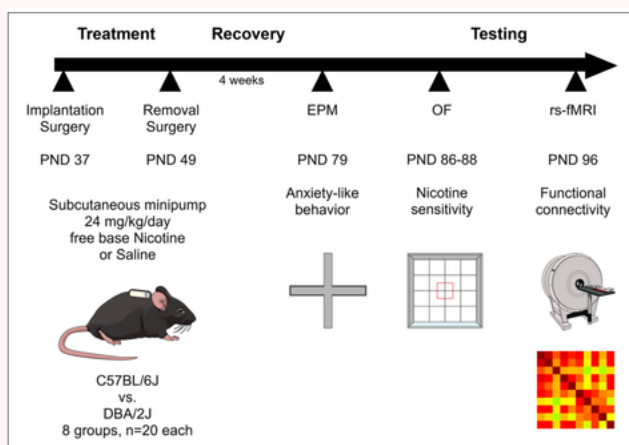
RURAL BANKS WERE MORE AFFECTED BY THE PANDEMIC THAN URBAN BANKS

The impact of COVID-19 on local banks was examined by comparing urban and rural areas. Data from 1,248 local banks in Indonesia between 2018 and 2022 showed that rural banks experienced higher credit risk costs and lower profitability. The difference was linked to the stronger fiscal capacity of urban local governments, reflected in higher tax revenues and education spending. Reducing the urban-rural capacity gap could strengthen resilience to future economic shocks.



Raz, A. F., & Gokmen, S. (2026). Bank performance under varying urban and rural governance: Evidence from the COVID-19 pandemic. *Journal of Regional Science*, 1–20. <https://doi.org/10.1111/jors.70087>

EFFECTS OF ADOLESCENT NICOTINE EXPOSURE ON BRAIN CONNECTIVITY VARY BY SEX AND GENETICS



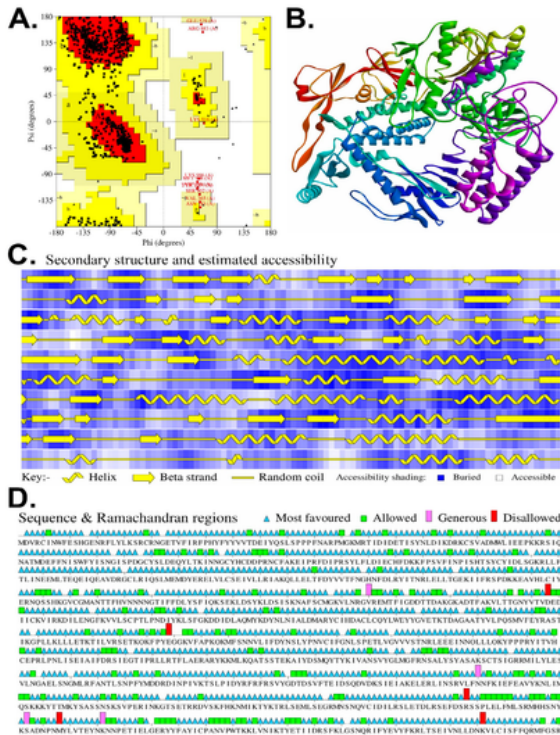
The long-term effects of adolescent nicotine exposure on adult brain connectivity and behavior were investigated in mice from two genetic strains. Male and female mice underwent anxiety and activity tests as well as resting-state brain imaging. The effects varied by sex and genetic background and were more pronounced in females. One strain showed widespread disruptions in brain networks, while the other exhibited reduced anxiety and increased activity. The findings may contribute to the development of more personalized treatment approaches.

Ünsal, H. S., Novoa, C., Zhang, N., & Gould, T. J. (2026). Genetic background and sex moderate the effects of adolescent nicotine exposure on adult functional neural circuits and behavior. *Journal of Psychopharmacology*, 1–23. <https://doi.org/10.1177/02698811261464981>



NATURAL PEPTIDES SHOW PROMISE AGAINST MPOX VIRUS IN COMPUTATIONAL STUDY

In the search for new treatment options against mpox virus, 19 natural antimicrobial peptides produced by lactic acid bacteria were computationally screened against the viral DNA polymerase enzyme involved in replication. Binding analyses and molecular dynamics simulations identified Sakacin P and Mundtacin KS as the most promising candidates. Both peptides showed strong binding and formed stable, long-lasting interactions with the enzyme. The findings highlight their potential as antiviral drug candidates, although further laboratory studies are needed to confirm their effectiveness.



Karaman, M. Z., Goel, K., Zanchi, F. B., Ozdarendeli, A., Mujwar, S., Yetiman, A. E., & Fidan, O. (2026). Virtual screening of bacteriocins from lactic acid bacteria against monkeypox DNA polymerase: Sakacin P and Mundtacin KS emerge as promising candidates. *Food Science & Nutrition*, 14(8), e72219. <https://doi.org/10.1002/fsn3.72219>

LARGE NINE-LANGUAGE DATASET DEVELOPED FOR HUMAN VALUES IN POLITICAL TEXTS

A comprehensive dataset in nine languages, including Turkish, was developed to examine how human values are expressed in political texts. Experts annotated news articles and political party manifestos sentence by sentence, covering 2,648 texts and 74,231 sentences. Each statement was classified according to the value it reflected and whether that value was supported or portrayed as being under threat. Security, achievement, and conformity were among the most frequently identified values. The dataset can serve as a benchmark for developing computational models for automated human value detection.

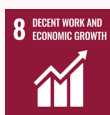
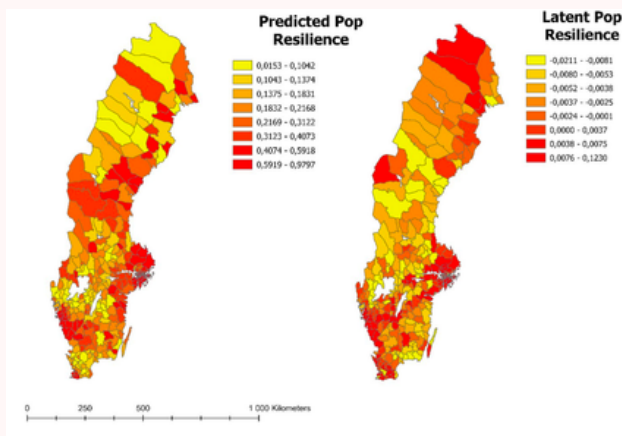


Scharfbillig, M., Reitis-Münstermann, T., Stefanovitch, N., Kiesel, J., Schulze Brock, P., Sneddon, J., Cartier,....Coymak, A.,... Ye, S. (2026). ValuesML: A new multilingual dataset for values detection in news and political manifestos. *Behavior Research Methods*, 58, Article 276. <https://doi.org/10.3758/s13428-026-03092-z>



CENTRAL POSITION IN COMMUTING NETWORKS HELPS RETAIN LOCAL POPULATIONS: EVIDENCE FROM SWEDEN

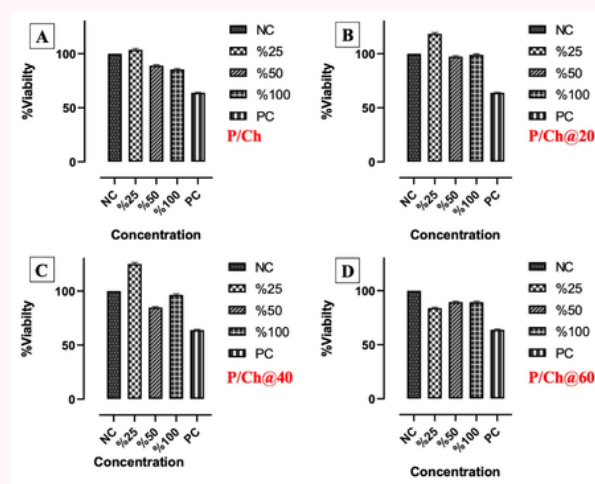
The ability of Swedish municipalities to retain their populations was examined through commuting networks. Using records from more than 1.2 million working-age individuals between 2003 and 2013, researchers modeled the risk of relocation. Municipalities with more central positions in commuting networks and greater access to nearby employment opportunities showed lower relocation risk, while more dispersed commuting patterns were associated with increased mobility. Age, education, family structure, and migration background also influenced relocation. The findings may contribute to regional resilience and population planning.



Türk, U., Östh, J., Stanković, J., Marjanović, I., Džunić, M., & Stanojević, M. (2026). Commuting flows and regional resilience: A socio-spatial analysis of population change in Sweden. *Networks and Spatial Economics*. Advance online publication. <https://doi.org/10.1007/s11067-026-09758-7>

STEVIA-ENRICHED MEMBRANES SHOW PROMISE AS ANTIMICROBIAL WOUND DRESSINGS

Stevia leaf extract was incorporated into polyvinyl alcohol and chitosan-based membranes to develop new materials for protecting wounds against microbial infections. The membranes showed strong antibacterial activity against *Escherichia coli* and *Bacillus subtilis*, while their effect against *Candida albicans* was limited. Cell tests demonstrated over 80% cell viability and supported cell migration. The findings suggest that these membranes could be promising materials for wound dressing and tissue engineering applications.



Pehlivan, İ., Atakav, Y., Badem, M., & Kanbolat, Ş. (2026). Stevia functionalized PVA–chitosan membranes as novel antimicrobial wound dressing materials. *Applied Sciences*, 16(14), 7180. <https://doi.org/10.3390/app16147180>



IMPACT OF HIGHWAY EXPANSION ON ENERGY USE AND CARBON EMISSIONS VARIES ACROSS COUNTRIES

The relationship between highway expansion, transport-related energy consumption, and carbon emissions was examined across 30 European countries, including Türkiye, using data from 2011 to 2020. Highway expansion was associated with increased energy demand in countries with low energy consumption but reduced demand in high-consumption countries. Its relationship with carbon emissions was generally negative across most levels. The findings highlight the importance of considering country-specific conditions when developing transport and climate policies.

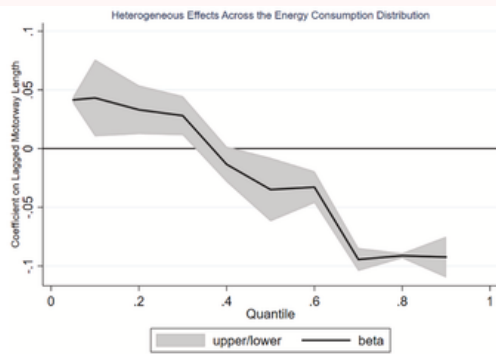


Fig. A1. Quantile-specific coefficients of lagged motorway length: Energy model.

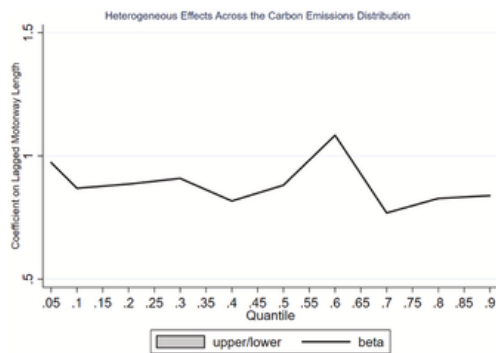


Fig. A2. Quantile-specific coefficients of lagged motorway length: Carbon model.



Peker, M. S., Türk, U., & Ustaoglu, E. (2026). Highway expansion and the dynamics of energy use and carbon emissions in Europe. *Transport Policy*, 188, 104361. <https://doi.org/10.1016/j.tranpol.2026.104361>

STRONG ALGORITHM SELECTION OUTPERFORMS PREPROCESSING FOR IMBALANCED DATA

The effects of data preprocessing and algorithm selection were compared in binary classification problems involving class imbalance and class overlap. A total of 6,960 experiments were conducted using 58 datasets, 11 balancing techniques, and 10 classifiers. While preprocessing improved performance by an average of 4.13 points for the same classifier, it resulted in a 4.64-point decline when compared with a strong baseline classifier. Overall, algorithm selection was found to be about 16 times more influential than the choice of preprocessing technique, while dataset characteristics had the greatest impact on performance.

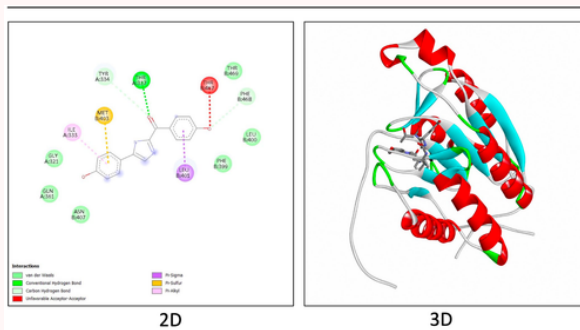
Kaya, S., & Ünlü, R. (2026). Overlap mitigation versus classifier selection in imbalanced classification: A dual-baseline analysis. *Applied Sciences*, 16(14), 6905. <https://doi.org/10.3390/app16146905>

Mean $\Delta F1$ (%) by Technique $\times$ Stratum (Honest LODO Baseline)					
Oversampling	SMOTE	0.36	-6.62	-11.99	-8.98
	BorderlineSMOTE	0.16	-7.12	-12.32	-9.15
	SMOTE+Tomek	0.37	-6.56	-12.02	-9.01
	CBO	-0.25	-6.53	-13.15	-9.27
	ADASYN	-0.32	-8.60	-13.25	-8.52
	SMOTE+ENN	-1.42	-8.67	-11.46	-10.63
RandomOverSampler	-2.13	-9.10	-13.15	-8.99	
Undersampling	ENN	-4.05	-11.52	-14.16	-13.13
	NCR	-4.48	-11.22	-15.61	-12.51
	RENN	-4.29	-12.50	-14.57	-13.59
	Tomek Links	-6.32	-11.03	-16.15	-12.02
		Low	Medium	Good	High
Baseline F1 stratum					



IMIDAZOLE-DERIVED COMPOUND PROTECTED NERVE CELLS AGAINST OXIDATIVE DAMAGE IN LABORATORY TESTS

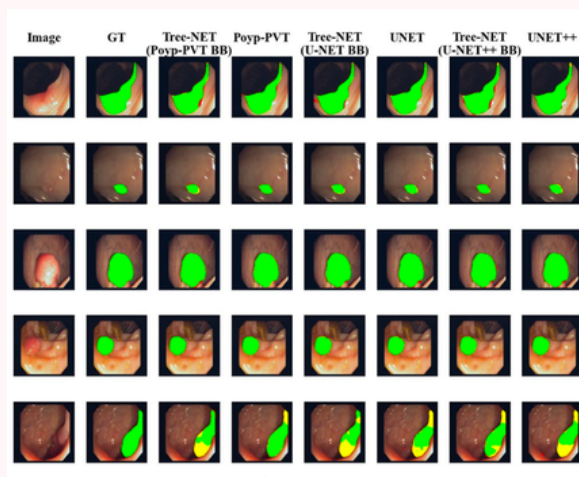
The protective effect of the imidazole-derived compound IMD-1 against oxidative damage associated with neurodegenerative diseases was investigated in a human neuronal cell line. In cells exposed to hydrogen peroxide-induced damage, pretreatment with 25 micromolar IMD-1 increased cell viability from 53% to 92%. Reduced free radical levels and preserved mitochondrial function and energy production were observed. The release of inflammation-related molecules and cell death were also reduced. Potential target protein interactions were evaluated through computer-based analyses. The findings were emphasized as requiring validation in animal models.



Derya-Andeden, M., Altin-Celik, P., Tokguner, N. E., Turan, A., Eciroglu-Sarban, H., & Donmez-Altuntas, H. (2026). IMD-1 protects SH-SY5Y cells against H₂O₂-induced oxidative injury through modulation of oxidative stress, mitochondrial bioenergetics, inflammatory mediator release, and apoptosis-related responses. *Neurochemical Research*, 51, Article 236. <https://doi.org/10.1007/s11064-026-04861-0>

AI MODEL SEGMENTS MEDICAL IMAGES WITH LOWER COMPUTATIONAL POWER

A new artificial intelligence architecture called Tree-NET was developed to automatically identify diseased regions in medical images. The model enabled images and labels to be processed in compressed form. Tested on two datasets containing colonoscopy and skin lesion images, the method was found to require 4 to 13 times less computational power than existing models. Memory consumption was reduced while accuracy was maintained or improved. The highest performance on the skin lesion dataset was achieved with this method. The model was considered suitable for clinical settings with limited hardware resources.



Demirci, O., & Yilmaz, B. (2026). Tree-NET: Enhancing 2D medical image segmentation through efficient low-level feature training. *Neural Computing and Applications*, 38, Article 688. <https://doi.org/10.1007/s00521-026-12420-5>

