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Dear Students and Young Researchers,

We are delighted to address you—the brilliant minds driving innovation and intellectual exploration. Your unwavering commitment to advancing knowledge and pushing the boundaries of research is truly inspiring.

As emerging researchers, you are not merely scholars; you are pioneers. This is your moment to challenge the status quo, embrace bold ideas, and forge new paths. Approach this opportunity with enthusiasm, as it is through your creativity and courage that the horizons of human understanding are expanded.

Remember, you are not alone on this journey. A vibrant community of researchers and mentors stands ready to support and guide you. Seek their wisdom, engage in meaningful discussions, and embrace collaboration. The essence of academia lies not only in individual achievements but also in the collective synergy of ideas that drives progress.

As you embark on this exciting journey, hold onto your curiosity, question assumptions, and never cease to explore. The world eagerly awaits your discoveries, and your work has the potential to create a lasting impact.

With profound admiration for your dedication to knowledge and innovation,

NYCSEA Co-Editors-In-Chief

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THE REMOVAL OF COPPER (II) SULFATE CONTAMINATED WATER USING CHEMICALLY

Vienna Choong, Chase Im

Abstract: Currently, activated charcoal is used to remediate heavy metals from water, but it can be expensive. Alternatives such as rice husk-derived biochar can be used as a cost-efficient method of remediating heavy metals. This study aimed to determine the most effective particle sizes (0.149, 0.42, 0.85 mm) of rice husk biochar compared to activated charcoal. The activated carbon was chemically treated using potassium hydroxide and thermally treated at 600□. The exposed solution was then filtered and assessed using a spectrophotometer and the Beer's Law plot. The data was analyzed in SPSS version 28 using a One-Way ANOVA post hoc Scheffe ($p<0.05$). Results showed that the concentration of CuSO4 after remediation was significantly reduced ($p<0.01$) when implementing biochar with sieve sizes of 0.149 mm rather than activated charcoal, with average concentrations of 0.024 ± 0.0095 M and 0.0047 ± 9.54 M remaining, respectively. The 0.149 mm particle size resulted in the highest percentage removal (76 ± 9.54%) compared to the activated charcoal (6.57 ± 8.11%). The promising results displayed by rice husk-derived biochar with a particle size of 0.149 mm can be attributed to the high surface area, allowing for increased contact efficiency in remediation. The results of this study showed that rice husk-derived biochar was an efficient alternative to activated charcoal in remediating CuSO4. Future studies should consider using this material to remediate alternative pollutants, such as textile dyes, including methylene blue.

Keywords: Rice Husk Biochar, CuSO4, Particle Size

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The Effect of Polyethylene Microplastics on the Growth of Lemna minor

Talie Lin, Elivia Choong

Abstract:This study investigated the impact of polyethylene microplastics on the growth, root length, and chlorophyll-a content of Lemna minor (duckweed) while evaluating its potential as a phytoremediation tool to address microplastic pollution in aquatic ecosystems. Microplastics, prevalent in the environment, cause physiological stress in plants, and polyethylene is the most abundant type. Duckweed samples (1g per container in 500 mL freshwater) were cultivated for 7 days, then exposed to microplastic concentrations of 0 mg/L (control), 25 mg/L, 50 mg/L, and 100 mg/L for another 7 days. A One-Way ANOVA revealed no significant difference in the specific growth rate between the test groups. However, the highest mean frond count occurred at 50 mg/L (M = 768.875), and the lowest was observed in the control (M = 654.875). Root length decreased as microplastic concentration increased, plateauing after four days; the control group had the highest average root length (M = 0.631), while the lowest was seen at 50 mg/L (M = 0.485). Chlorophyll-a content declined significantly during the first four days ($p < 0.05$) but stabilized afterward, indicating potential plant adaptation. These results suggest that microplastics impair root development and chlorophyll-a content, likely by obstructing roots and reducing light for photosynthesis. Although growth rate remained unaffected, the findings highlight duckweed's potential to mitigate microplastic pollution, supporting its role in promoting cleaner and safer aquatic environments.

Keywords: Microplastics, Polyethylene microplastics, Lemna minor (duckweed), Aquatic ecosystems, Microplastic pollution

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From Decoration to Strategy: Positioning Artistic Expression as the Strategic Engine of Advertising Evolution

Yoovin Lee

Abstract: The research studies how advertising developed into a practice which unites strategic communication methods with artistic creativity. The paper shows how advertising evolved from basic trade symbols in ancient times through modern digital marketing by showing how advertisers evolved from basic image creators into designers of data-based interactive campaigns. The fundamental core of genuine creative expression has persisted as the permanent foundation of the field despite all technological and methodological advancements. The evolution of advertising depends on art which functions beyond visual appeal to create strategic effects that modify perceptions and generate emotional responses and social bonds. The paper demonstrates that art functions as the essential element which enables messages to move beyond commercial value to achieve human connection. We demonstrates how contemporary advertising combines cognitive psychology principles with deep cultural understanding and AI and AR technology to develop campaigns which connect with people emotionally while matching their specific contexts. The paper supports its analysis through an evaluation of two groundbreaking advertising initiatives which include H&M's Times Square flagship and AI-powered brand experiences. The examples demonstrate how creative elements unite with technological progress to create consumer engagement at deeper emotional levels which turns observers into interactive participants. Finally, we assert that successful advertising in the future requires uniting artistic storytelling with strategic intent and cultural understanding through a balanced approach. The combination of artistic elements with strategic elements proves that art serves as the fundamental element which makes advertising both impactful and enduring.

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HEATWAVES AND HEALTH RISKS IN NEW YORK CITY

Amanda Liang, Sarah Wu

Abstract: Heatwaves, locally defined as having at least three consecutive days with temperatures exceeding 90 °F, pose a significant and growing risk to public health in New York City (NYC), particularly as climate change intensifies their frequency and severity. Rising global temperatures have led to more prolonged and intense heatwaves that exacerbate health risks, especially for vulnerable populations. The urban heat island (UHI) effect further exacerbates these risks by increasing localized temperatures in densely built environments. As extreme heat events have increased in NYC, the health burden associated with them has become a pressing concern. The heatwave season now lasts significantly longer than in past decades, contributing to hundreds of heat-related emergency department (ED) visits and hospitalizations each summer. Consequently, emergency response systems face increased strain. This study seeks to quantify the relationship between heatwaves and heat-related ED visits and project future health impacts under different climate scenarios.

The analysis incorporates NYC historical climate and air pollution data, along with ED visit records from May to September during 2017–2023. Climate projections (2015–2100) are derived from 21 CMIP6 climate models under three Shared Socioeconomic Pathways (SSPs) (SSP 2-4.5, SSP 3-7.0, and SSP 5-8.5) that model different greenhouse gas emissions and climate change scenarios. We defined various climate measures related to temperature, humidity and air pollution and examined their correlation with heat-related ED visits. We further used a distributed lag non-linear model (DLNM) with quasi-Poisson regression to assess the potentially nonlinear and delayed effects of each candidate risk factor on heat-related ED visits. The best fitted model, identified by the smallest deviance, suggested that daily maximum temperature is the best predictor. Fitted values from this model estimated the relative risk of heat-related ED visits during heatwave conditions to be as high as 7.93 with 95% CI (7.71, 8.16), indicating that heatwaves are a significant risk factor for heat-related ED visits. Assuming the expected number of heat-related ED visits during non-heatwave days does not change over time, future projections of heat-related ED visits in 2075-2100 were calculated using both estimated relative risk and the projected increase in total heatwave days compared to 2017-2023 based on different climate models. The medical cost of these events is projected to range from $70 million (under SSP 2-4.5) to $1.2 billion (under SSP 5-8.5). If effective risk mitigation strategies successfully reduce the daily maximum temperature by 0.5-1 °C, then the maximum medical cost for all heat-related ED visits in 2075-2100 would be reduced by $137-$286 million. If combining adaptation, increasing in public awareness and other effective risk mitigation strategies could lower the relative risk of heatwaves on heat-related ED visits by 25-50%, the corresponding maximum medical cost could be reduced by

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.$384-$686 million
This study underscores the urgent need for proactive policies to protect NYC residents from the increasing threat of heatwaves. By integrating climate resilience strategies into urban planning, public-health initiatives, and insurance frameworks, policymakers can work toward reducing the human and economic costs of extreme heat events while ensuring long-term sustainability and public .safety

Keywords: climate change, heatwaves, heat-related emergency department (ED) visit, distributed lag non-linear model (DLNM), population health, shared socioeconomic pathways (SSPs), CMIP6 climate models, climate projections

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Helmholtz Coils: Modeling Qubit Interaction with PIDs

Leo Titievsky

Abstract: The hardware to produce the magnetic fields was left over from previous development on the model. Thus, our primary concern in the making of a multi-Bloch sphere model was in the following objectives: Firstly, I wanted to produce a means by which multiple Bloch Spheres could be put into a single network and addressed individually based on instructions from a single controller. Secondly, I wanted a means by which readout, in the form of the vector produced by the physical system - the orientation of the internally suspended indicator - could be reported and processed automatically. Lastly, I wanted a method by which one system would seek to mimic the state of another by means of utilizing the readout mechanic of the other system. While not a perfectly accurate representation of a related, real world, concept in quantum error correction (QEC), in implementing this feature, I sought to verify the models ability to represent interactions between states - a feature required for the multi-sphere model to be of any use.

Many tools used to drive the previous iteration of the Bloch Sphere demo -although effective for their intended purpose- were not feasible to use with these new objectives, and as such every piece of control hardware and software had to be reimagined.

With our constraints outlined, I could begin the design process. The power supply units used to drive the coils of the Bloch Spheres, up until this point, had been driven using a USB hub connected to a laptop. Considering our first objective-to have multiple Bloch Spheres addressed independently by a single control unit-We deemed this not the best way to create an expandable system. As such, I replaced the 3 port USB hub with a network switch as it allowed for each coil to be addressed independently, and for coils to have a configurable IP address - allowing for convenient testing and coding convention. This was as opposed to a larger USB hub, as that would have led to a more difficult implementation than the local network I ended up creating with the ethernet switch. The power supplies available to us, namely the Keithley 2450 Sourcemeter, were addressable over ethernet via the VISA utility from National Instruments. Thus, I chose to write the control logic for the system in Python as the PY-VISA utility allowed us to write TSP commands to the power supplies, allowing us to control them remotely and automatically.

I extended existing tools for mechanically displaying quantum states to feature a network of multiple states that use automatic data collection and processing to interact in real time, thus vastly improving their utility. By utilizing Bluetooth enabled IMU sensors I was able to glean an interpretable readout from

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otherwise visual-only models. This readout data could then be recorded and fed to control logic to influence the states of other qubit models. The system was constructed and went through successful test runs. I discuss the developmental process as well as potential applications of this extended demonstration model.

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Assessing Intersectionality in Barbie: A Mixed-Method Analysis of the 2024 Barbie Fashionista Collection Against UN Standards

Myreen Malik

Abstract: This study evaluates the 2024 Barbie Fashionista Collection through the lens of intersectionality, using enablers from the United Nations' Intersectionality Resource Guide and Toolkit as a benchmark. With Barbie's increasing emphasis on diversity and inclusion, this research aims to assess the depth and authenticity of these efforts by analyzing whether the dolls embody multiple, overlapping marginalized identities and promote social justice. A mixed-method inventory case study was employed, coding 23 dolls against four adapted UN enablers: Dignity, Choice and Autonomy; Diverse Knowledges; Intersecting Identities; and Transformative and Rights-Based. Findings revealed that while 87% of dolls represented at least one marginalized identity—achieving a high score in Dignity, Choice and Autonomy—the collection largely fell short in consulting marginalized communities (13%) and promoting rights-based themes (13%). Only two dolls fulfilled all four enablers, with most categorized as only slightly intersectional. Chi-squared analyses showed equitable representation across skin tones, but significant underrepresentation of varied body types and borderline underrepresentation of disabilities. These results suggest that Barbie's inclusivity is largely surface-level, with limited engagement in deeper, intersectional design. The study recommends that Mattel increase the integration of intersecting identities, consult more diverse voices in the design process, and introduce educational, rights-focused narratives to achieve more robust intersectionality.

Key words: Intersectionality, Barbie Dolls, Representation, Diversity and Inclusion, UN Standards, Child Development, Marginalized Identities

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The Effect of Dietary P. dactylifera Concentration on Memory Loss in Drosophila Expressing Alzheimer's Gene

Noor Sohail

Abstract: This study aimed to investigate the impact of Phoenix dactylifera (dates) on the progression of Alzheimer's disease (AD) in Drosophila melanogaster. AD is a prevalent neurodegenerative disorder that causes memory loss. It is hypothesized that incorporating dates into the diet of genetically modified Drosophila (fruit flies) expressing the amyloid precursor protein (APP) would alleviate memory loss. The experimental design involved four groups: wild-type flies and three APP-modified groups receiving 0%, 2%, and 4% date concentrations in their diet. A T-maze with olfactory learning assessed the flies' memory retention by associating a positive reinforcement with a banana odor and a negative reinforcement with an electrical shock. The flies were tested every other day over a 12-day period, and their initial entries were recorded and analyzed for results. The results indicated that the wild-type flies preferred the conditioned arm (odor), confirming the validity of the T-maze as a test to correlate cognition. Flies with the 4% date concentration had a P-value of .95 when compared to wild-type. This suggests that flies with the 4% date concentration significantly improved memory performance. However, flies receiving 0% and 2% date concentrations showed fluctuating entries into the conditioned arm with a P-value of 1, suggesting no improvement in memory. These findings indicate that the hypothesis was partially supported, with the 2% date concentration having no effect, but the 4% slowing cognitive decline in the Drosophila models. This study provides an avenue for further research on dates and their impact on AD.

Keywords: Alzheimer's, Drosophila Melanogaster, Phoenix dactylifera, Dates

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Adaptive Haptic Feedback Device for Regulatory Role of IL-17Ra Signaling in Stromal Cells of the Intestine: Impact on Intestinal Epithelium Differentiation and Crypt-Villus Morphogenesis

Samaya Syali

Abstract: It is crucial to investigate the mechanism in how exactly IL-17Ra signaling is affecting the differentiation of intestinal epithelial cells. To do this, Pdgfra mediated secretion of factors such as Wnt ligand and r-spondins need to be analyzed. These factors are required for intestinal epithelial cell differentiation, and need to be quantified in the wild-type and IL-17Ra knockout mice in order to see if the IL-17Ra signaling pathway is affected. Since tuft cells are involved in sensing parasites, immune modulation and overall play a positive role in the immune system, the downregulation may lead to susceptibility to various diseases and an increased likelihood of inflammation. The loss of tuft cells may disrupt the intestinal epithelium's role, and the barrier's ability to regulate immune function, and thus negative gastrointestinal symptoms in humans. This is why the tuft cell function should be tested.

While histological analysis, alcian blue staining, but not qPCR analysis showed an increased number of goblet cells it may be crucial to analyze the function of the goblet cells. Since Muc2, the qPCR marker used, is an indicator of mucin production which is a marker for goblet cells, it may be possible that mucin production is altered. It is important to then analyze goblet cell function, or another qPCR marker of goblet cells, in order to confirm the last qPCR results.

Histological analysis, hematoxylin and eosin staining, showed an increased length of the crypt villi in IL-17Ra knockout mice. This suggests that IL-17Ra is affecting the differentiation, proliferation or migration of specialized cells in the intestinal epithelium. This elongation may be a compensatory mechanism in order to maintain barrier function. Thus, other factors previously mentioned such as gut microbiota quantification, and the quantification of Pdgfra mediated secretion of factors must be analyzed.

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Enhancing Staple Crop Resistance to Mosaic Virus: The Effect of Mutant Systems on Homologous DNA Pol Delta in Nicotiana Tabacum and Manihot Esculenta

Sarah Phinney

Abstract: Throughout this experiment, specific sites and mutations on pol delta were observed to determine which would have the greatest effects on the final polymerase molecule. Ideally, these changes would positively impact DNA replication. For the physical plant science laboratory component, folic acid (a B vitamin)'s presence was studied to determine its effect on tobacco seedling growth.

It was hypothesized that specific sites and mutations on the pol delta protein, for example G680V, would affect cassava resistance to CMD by altering the functionality of pol delta and therefore the reliable production of high-quality DNA. G680V in particular was researched for its potential to allow the "fingers" of pol delta to move excessively and potentially interfere with DNA reproduction. Additionally, the hypothesis that folic acid would increase the growth of tobacco seedlings was tested.

Materials included computers with Visual Molecular Dynamics (VMD) software, Nicotiana tabacum seeds, Petri dishes, folic acid, potting mix, and a dissection microscope.

This project required the physical handling of Nicotiana tabacum, which has been known to cause nicotine poisoning in workers handling the crop. However, this only occurs when proper precautions are not taken and there is a lengthened exposure to the material. Thus, when performing this part of the procedure, all biological material was carefully disposed of in a manner comparable to if it were an invasive species—the plant matter will be bagged and thrown away, not burned. Biosafety Level 1 was observed for the duration of the laboratory.

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A Novel Air Quality Assessment Method With Low-Cost Sensors and Predictive Analytics Using Autonomous Drones

Sathvik Dasari

Abstract: This project presents a novel method for real-time air quality monitoring using a low-cost, modular sensor system designed for future drone integration. Traditional monitoring stations are expensive, stationary, and lack spatial resolution, while most portable systems offer limited accuracy or predictive capability. This work bridges that gap by combining affordability, mobility, and intelligent analytics into a single, scalable solution.

The prototype uses a Raspberry Pi platform integrated with MQ-series gas sensors (CO, NO□, NH□) and a BME680 environmental sensor. Data is collected at 15-second intervals, timestamped using NTP synchronization to minimize drift, and processed through machine learning models. A Random Forest Regressor was trained on the AirQualityUCI dataset to predict pollutant levels, while DBSCAN was used to identify pollution anomalies. All models were optimized for on-device inference using TensorFlow Lite with quantization

The system was tested in three distinct environments urban intersections, residential neighborhoods, and construction zones over six 30-minute sessions. Performance metrics showed strong predictive accuracy with R^2 scores of 0.85 for CO, 0.81 for NO□, and 0.91 for NO_x. Mean Absolute Errors ranged from 0.071 to 0.156 ppm, with real-time prediction latency of ~1 second and average uptime of 5.5 hours per battery cycle. Compared to consumer-grade and government-grade monitoring systems, the proposed model offers a competitive balance of cost, accuracy, and real-time capability
.
This approach lays the foundation for future drone-based deployments, enabling rapid, distributed air quality surveillance in both urban and underserved regions

Keywords: Air Quality Monitoring, Low-Cost Sensors, Autonomous Drones, Predictive Analytics, Machine Learning

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Utactss: Ultrasonic Technology-Assisted Communicative Tactile Surgical System

Sophia DeGregorio, Nabiha Islam

Abstract: The Ultrasonic Technology-Assisted Communicative Tactile Surgical System (UTACTSS) provides novel tactile feedback, characterized by an ultrasound reading and tactile sensation on the surgeon's fingertips, using piezoelectric micromachined ultrasonic transducers (PMUTs) and incorporates a preexisting force feedback system. The ultrasound reading is based on the interactions of shear waves generated by PMUTs at the end of the robotic arms with tissue at the surgical site. With shear wave elastography, these interactions are used to produce a colored tissue stiffness map that is superimposed onto the ultrasound image. This data is also used to determine the wave patterns of the ultrasonic waves generated by PMUTs in the surgical console. These ultrasonic waves provide accurate tactile sensation on the surgeon's fingertips that simulates the texture of the surgical site. This tactile feedback facilitates tissue detection and distinction, and the comprehensive haptic feedback prevents the surgeon from exerting excessive pressure on the surgical site.

Keywords: Robotic Surgery, Haptic Feedback, Ultrasonic Technology

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Assessing the Impact of Microplastics on Daphnia magna: Growth, Reproduction, and Physiological Responses in the Presence and Absence of Chlorella pyrenoidosa Algae

Thomas Fini, Matthew Kim

Abstract: Microplastics (MPs) enter aquatic food chains via ingestion by primary consumers and biomagnify through higher trophic levels. This study elucidated the impacts of this by assessing the effect of MPs on Daphnia magna's growth and reproduction with exposure to Chlorella algae as an additional food source. Daphnia were placed into four groups: Control, added MPs (2.22 mg/mL), added Chlorella, and both treatments. The Control and Chlorella-only groups maintained healthy heart rates at averages of 200±4 and 201±3 bpm, respectively; however, the MP-only group saw a significant decrease to an average of 181±2 bpm ($p<0.001$). Chlorella promoted MP ingestion, amplifying its negative impacts: the heart rate of this group was only 168±2 bpm ($p<0.05$). This same trend was observed for the body dimensions of the Daphnia, as groups solely exposed to MPs experienced significant decreases ($p<0.001$). Daphnia exposed to MPs developed ephippia, indicating a switch from sexual to asexual reproduction. This resulted in a significant reduction in reproduction, decreasing population sizes ($p<0.001$). Each negative trend was magnified by the presence of Chlorella ($p<0.05$). Thus, this study's findings indicate that the accumulation of MPs can decrease genetic diversity and population sizes among Daphnia due to increased asexual reproduction, leading to adverse effects on aquatic ecosystems. Future work should utilize oxidative stress assays to confirm that MPs caused the reproductive change.

Keywords: Microplastics, Daphnia magna, Chlorella pyrenoidosa, Oxidative stress, Reproductive strategy, Asexual reproduction, Genetic diversity, Ecotoxicology

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Investigating the Effect of Soybean on the Regeneration Rate of Dugesia Tigrina as a Model for the Mitigation

Emma Wang, Yihan (Anna) Wang

Abstract: Type II diabetes is one of the most prevalent diseases today; one effect of the increase in diagnoses being the rising price of insulin as a common treatment. This study investigated if exposure to raw soybean powder, a cheap yet strong antioxidant with abilities to reduce oxidative stress, could increase the regeneration rate of planarians, modeling the development of diabetes and serving as a possible treatment. Immediately after superior amputation, organisms were exposed to various solutions concentrations: them being 0 mg/10 mL, 0.25 mg/10 mL, 0.5 mg/10 mL, 0.75 mg/10 mL, and 1.0 mg/10 mL of soybean to spring water. Planarians were kept in their solutions and photographed multiple days post amputation until photoreceptors were fully developed and original areas were generally restored. Control group planarians required 9 days to fully regenerate, while the 0.5 mg/10 mL and 1.0 mg/10 mL concentrations displayed a significant reduction in regeneration time, needing only about 6±1.5 and 6 days respectively with p values of 0.046 and 0.023. In the 0.25 mg/10 mL however, planarians were recorded to regenerate in 12 days, mainly due to complications of asexual reproduction which altered area measurements. From this it was concluded that higher concentrations resulted in an accelerated regeneration rate by minimizing ROS levels in wound tissue, which may be implemented into the development of cheaper antioxidative treatments to prevent or mitigate the development of diabetes.

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A Novel Predictive Model for Forest Fire Burn Area Using Random Forest Regression in Python PSYCHOTHERAPY TRAINING WITH VIRTUAL PATIENTS

Sophia Fulton, Aidan He

Abstract: Wildfires are becoming more frequent and intense, threatening ecosystems, communities, and economies. In North America, fire activity increased dramatically in recent years, with over 61% of U.S. wildfires occurring since 2000. In response to increasing wildfire severity, new predictive tools are essential for mitigating damage and improving emergency response times. Traditional models such as the Analytical Hierarchy Process can be biased due to their reliance on pairwise matrices, and Random Forest has proven to be a viable alternative. This study presented a predictive model using Random Forest regression to estimate the burn area of forest fires based on climatic variables. The model was trained on historical fire data across the United States, integrating temperature, wind speed, relative humidity, and burn acreage and fire start coordinates from nearly 9000 fires. Data preprocessing included normalization, Gaussian noise, and non-linear scaling. The model achieved an R2 value of 0.8421, indicating a strong correlation between climate variables and fire burn area. While the model effectively predicted smaller fires, it exhibited underestimation for larger fires due to averaging effects in decision trees. Limitations included the exclusion of anthropogenic factors and data imbalances. Future research should integrate anthropogenic variables, explore deep learning, and account for extreme events. This model can provide valuable insights for policymakers and emergency response teams, aiding in wildfire risk management.

Keywords: Wildfire, Machine Learning, Model, Random Forest, Gaussian Noise, Bootstrapping, R2

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