

# Adaptive Climate Education: Harnessing Neural Architecture Search for Tailored Regional Learning Paths

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## Abstract

As climate change intensifies, there is a growing need for educational solutions that are personalized to the unique environmental and socio-economic challenges faced by different regions. Current climate education models tend to apply a standardized approach, which fails to address the diverse needs and vulnerabilities of specific communities. Our project addresses this issue by leveraging Neural Architecture Search (NAS) to develop an adaptive model that delivers regionally tailored climate education content. NAS is a machine learning technique that automates the design and optimization of neural network architectures by exploring different configurations, such as the number of layers, neurons, and types of connections. The NAS framework evaluates architectures like Convolutional Neural Networks (CNNs) for multimedia content and Transformers for text-based learning, ensuring the most efficient architecture is selected for each region. This approach enables the model to balance performance and computational efficiency. Our methodology begins with the collection and analysis of local and regional educational and environmental data, which is then scaled for broader application. First, we gather educational data from multiple sources, including literacy rates, technology access, and student performance metrics from UNESCO, the World Bank, OECD, and PISA. This data is preprocessed and used to define the NAS search space. Neural Architecture Search (NAS) is employed to explore various neural network architectures, such as CNNs for multimedia content and Transformers for sequential learning. The NAS framework evaluates and optimizes these architectures based on performance metrics like computational efficiency and learning outcomes, ensuring they meet the specific needs of different regions. Finally, the selected architecture is trained on the collected data, and the resulting model personalizes climate education content based on each region's unique challenges and resources. This iterative, data-driven approach ensures that the educational system remains adaptive, effective, and efficient across diverse socio-economic and environmental contexts. Through NAS, we can move beyond the standardized educational models that have been insufficient in addressing the diverse needs of global climate literacy. This platform transforms climate education into a flexible, regionally aware system, equipping learners with the tools necessary to address specific climate impacts, ultimately contributing to a more climate-resilient global society.

## Keywords

Neural Architecture Search (NAS), Personalized Climate Education, Machine Learning, Regional Adaptation, Convolutional Neural Networks (CNNs), Educational Data Optimization