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How Artificial Intelligence is used to Combat Climate Change

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I. INTRODUCTION

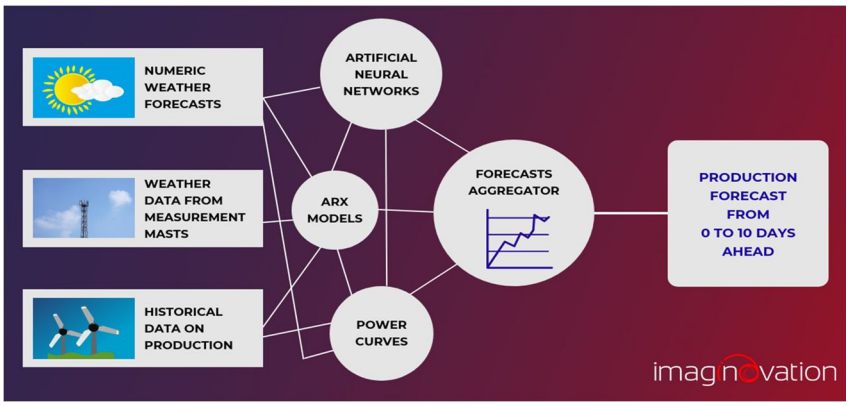
Advancements in technology are everlasting and improving lives around the world. Scientific breakthroughs in healthcare, such as the vaccines against the SARS-CoV-2 virus, are made possible by improvements in research systems. Laborious tasks, such as those in factories and restaurants, have begun replacing humans with machines to automate the same procedures. Technological improvements, such as those aforementioned, have been widely recognized throughout history for their positive impacts, but only recently have their negative effects been acknowledged, too. Since the Industrial Revolution, beginning in the late 18th century, factory work and manufacturing processes have required large amounts of energy input, and businessmen often utilized fossil fuels -- coal, oil, and natural gases -- to power their machines. To release the byproduct from their fuel consumption, industrial centers release foul gases into the air through smokestacks. These air pollutants gather in Earth's atmosphere and absorb excess heat from the sun -- referred to as "Global Warming." Although the world is progressing scientifically, its environment is degrading. Global Warming has recently been categorized as an urgent issue to resolve, and in response, legislation is being passed to combat nations' carbon emissions, engineers are designing solar-powered technologies, and influencers are promoting green energy lifestyles. Planning efforts to tackle climate change requires thorough research -- data collection, analysis, and forecasting -- and Artificial Intelligence (A.I.) is helping professionals research efficiently and create sustainable solutions. A.I.'s ability to analyze trends of new technologies' effects on global warming and provide insights on the positive and negative aspects of green energy methods makes it the key component for advancing renewable energy and sustainability around the world.

Before analyzing the benefits of A.I., it is crucial to understand what it is: Artificial Intelligence is the technology designed to emulate human behavior. It analyzes data to find patterns, and designs algorithms for classification and prediction tasks, "often using real-time data" (West 7) to power its computations. For example, facial recognition software utilizes Artificial Intelligence to function. To classify a face and match it with a specific person, the A.I. software analyzes patterns and characteristics of a person's face, so when the time comes to classify it, it has enough information to make an accurate prediction. An Artificial Intelligence machine is only as good as the data it is provided with, so engineers use lots of sensors and devices to collect data for inputs to the A.I. machines, allowing the A.I. to "combine information from a variety of different sources, analyze the material instantly, and act on the insights derived from those data" (West 7). A.I.'s ability to make decisions in real-time and based on variances in its inputs make it very beneficial in analyzing new data presented to it.

This feature, however, is not limited to simple consumer appliances like applications on phones; on larger levels, it is a primary component for spreading renewable energy across the world in the fight against climate change. Artificial Intelligence analyzes trends in various data to define algorithms and make predictions to advance impact decoupling. Impact decoupling is the process of maintaining economic outputs while decreasing the negative environmental impact of an activity. Artificial Intelligence systems help limit CO2 emissions with their ability to "forecast the supply and demand of power in the grid, improve the scheduling of renewables, and reduce the life-cycle fossil fuel emissions through predictive maintenance" (Malliaraki 6). A.I. provides analyses of customers' energy consumptions to companies so that they and members of the Environment Protection Agency (EPA) can select when in the year they should increase their green energy supply. This allows companies to plan their spending and production to replace fossil fuel emissions with renewable energy, while still retaining their profits. Artificial Intelligence helps impact decoupling in the transportation industry, too. A.I. enables "more accurate traffic predictions, the optimization of freight transportation, and better modeling of demand and shared mobility options" (Malliaraki 6). With advanced traffic predictions, freight transportation and cargo shipments can take optimized routes and reduce their travel time and fuel emissions. The detailed models provided by A.I. systems help these companies estimate how much of their product they should produce, lowering transportation costs and weight. Excess weight requires more power to transport the packages, which in turn emits more foul gases into the atmosphere. A.I. is a key factor in promoting impact decoupling, but there are numerous other instances where A.I. is helping achieve a greener environment.

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In addition to helping businesses achieve impact decoupling with its advanced data examination and prediction efficiency features, Artificial Intelligence is directly being utilized in new products to make them eco-friendly. Companies like Tesla, NVIDIA, and Unity Technologies are applying Artificial Intelligence to develop electric, self-driving vehicles, to reduce their customers' consumption of fossil fuels. Most gas is burned and emitted when driving at high speeds, braking, and accelerating. Self-driving vehicles "cut these factors out of their driving style, meaning less gas is burned, or battery power consumed, resulting in less air pollution" (Rose-Harman 17). Self-driving cars can efficiently allot the car's power to its features and prevent an over-exertion of energy being used on a task that does not require as much. Furthermore, self-driving vehicles are lighter than their driver-required counterparts, thereby using "less fuel and energy" (Giles 7) and causing less harmful emissions. They also have fewer parts, hence they use less plastic (Giles 8). Self-driving vehicles are directly helping attack a prime factor for the growth of Global Warming: plastic. Plastic consumption is one of the largest factors for the rapid progression of climate change, and self-driving vehicles are cutting down the need for this material. Self-driving cars are a substantial contributor to the fight against climate change, and Artificial Intelligence is the backbone of this new technology.



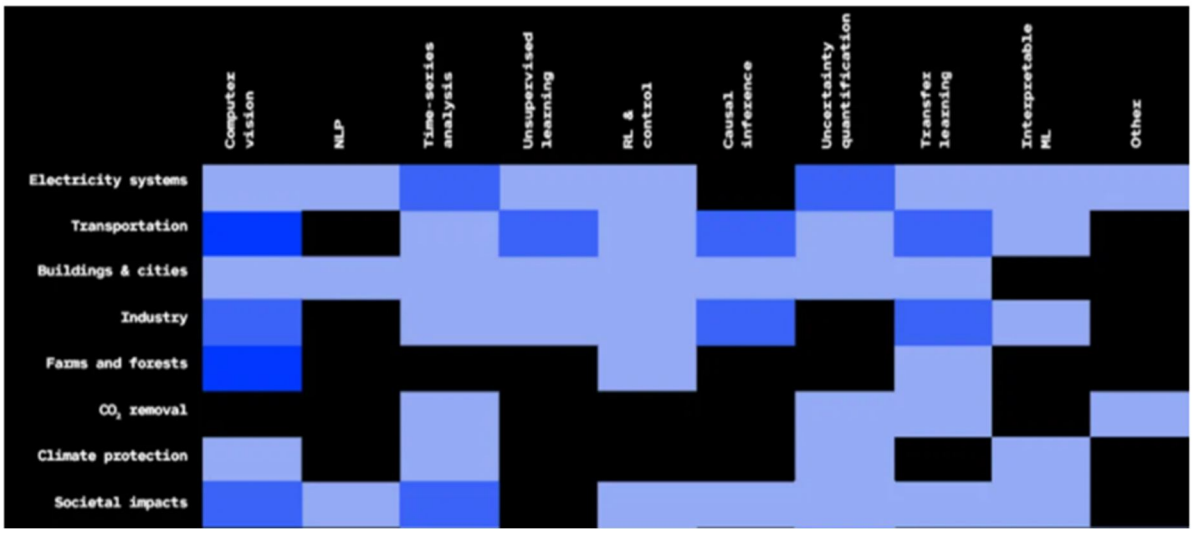
Demonstration of grid control system with

Artificial Intelligence **(**Georgiou 3).

Artificial Intelligence's impact on spreading renewable energy has exceeded factory processes and consumer products: A.I. has begun being used directly in energy and power management. The energy grid contains sensors and devices which collect readings from the grid's channels. Artificial Intelligence is coupled to "give new insights to the grid operators for better control operations" (Georgiou 18), such as power regulation based on seasonal changes and weather conditions. With this information, energy suppliers can be flexible with their power production, managing supply for accurate demand estimations. Moreover, A.I. automated control systems manage equipment like furnaces and AC (Alternating Current) units, which helps reduce the chance of mistakes when managing the grid. Smart machines "automatically switch off when the power supply is low" (Georgiou 19) and adjust based on the flow of supply. This helps green energy companies reduce the risk of supplying extra power, which helps them save energy and spread it to a larger customer base. With continuous progress, this technology can be applied to more energy providers to help convert more homes to renewable energy.

Artificial Intelligence is used in various industries for its data analytics and optimization features that help combat climate change. A.I.'s data interpretation allows users to recognize patterns and make adjustments to their systems, accordingly, so that they can maximize their potential and be environmentally friendly. Its algorithms and predictions help companies switch their production processes to renewable energy sources without losing their economic outputs. And A.I.'s operations management allows power grids to be controlled by a central unit to efficiently manage supply. Artificial Intelligence is more than just the Siri feature on an iPhone, or the Alexa used to control your home's appliances. Artificial Intelligence is the future of an everlasting, greener world. Its potential to spread renewable energy is limitless.

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This chart shows the possible fields that Artificial Intelligence helps combat climate change in (Hau 1).

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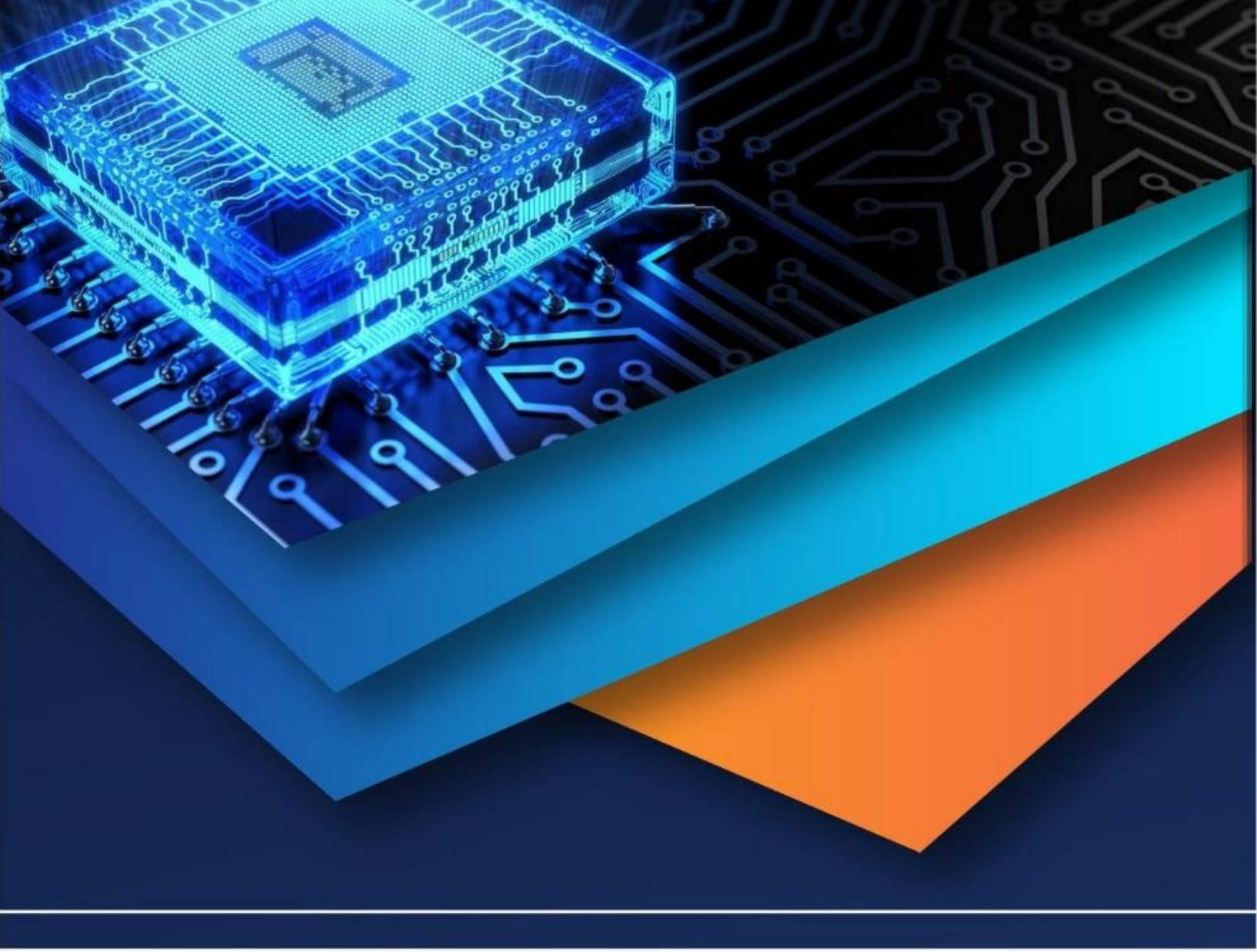
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