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Singapore: AI-Powered Solutions to Tackle Climate Risks

Alita Sharon

The increasing unpredictability of weather caused by climate change has made farmers especially vulnerable to financial losses. To address this challenge, researchers from NTU's Nanyang Business School have developed an innovative machine learning-based insurance model designed to provide better protection against weather risks.

Led by Associate Professor Zhu Wenjun and Assistant Professor Zhang Jinggong, the team's approach could transform how insurance mitigates agricultural losses while offering financial security to farmers.

The researchers employed neural networks, an advanced form of artificial intelligence (AI), to analyse the complex and non-linear relationships between weather variables – such as temperature and rainfall – and crop production losses.

These relationships often deviate from the straightforward assumptions of traditional linear models. Neural networks are capable of uncovering intricate patterns in high-dimensional data, making them well-suited for understanding the nuanced impact of weather on agriculture.

The team's findings challenge the conventional design of weather index insurance, which typically relies on linear relationships and faces limitations like high basis risk. Basis risk occurs when there is a mismatch between insurance payouts and actual

losses incurred by policyholders, leading to dissatisfaction and reduced demand. By reducing this risk through AI-optimised contracts, the new model offers a significant improvement over existing insurance products.

To test their approach, the researchers conducted an empirical case study to design an AI-based weather index insurance contract tailored for farmers. The results were striking: the AI-optimised contract could increase farmers' wealth by nearly 5% while lowering insurance premiums by 37% compared to the average price of conventional products. This dual benefit – enhanced financial security and affordability – has the potential to increase the market demand for such insurance policies.

The affordability of these AI-driven contracts is particularly critical, as cost remains a significant barrier to insurance adoption among smallholder farmers. By making the product more accessible, this innovation could provide a safety net for farmers facing adverse weather conditions, thus bolstering their resilience in the face of climate change.

The research holds significant implications for governments and public agencies tasked with supporting the agricultural sector. Traditional government subsidies for crop losses or disaster relief can strain public resources, particularly as extreme weather events become more frequent. The adoption of AI-driven insurance products could reduce this financial burden while ensuring that farmers receive timely support.

Moreover, these findings open avenues for governments to design more effective policies that integrate AI solutions into broader strategies for agricultural resilience. By aligning public and private sector efforts, such initiatives could provide a sustainable framework for addressing climate-related risks.

While the study focuses on agriculture, the broader implications of this research extend to other sectors and regions. The ability of neural networks to optimise financial products by capturing complex, non-linear relationships between variables could revolutionise industries such as healthcare, transportation, and energy. For example, AI could design insurance policies for natural disasters or pandemics, tailoring them to specific regional risks.

The research highlights the potential for AI to bridge gaps in financial security by making insurance products more responsive and cost-effective. This paradigm shift could pave the way for the widespread adoption of AI-driven solutions across borders, offering global benefits in risk management and economic stability.

For farmers, the introduction of AI-powered weather insurance signifies more than financial security – it represents an opportunity to thrive in the face of uncertainty. By reducing costs and improving payouts, these innovative contracts help farmers focus on long-term planning rather than short-term survival.

As climate change continues to challenge agricultural systems worldwide, this research underscores the transformative role that AI can play in fostering resilience. By leveraging cutting-edge technology, farmers, policymakers, and insurers alike can create a future where weather risks no longer threaten livelihoods and economic stability.

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