Research Project and Activities Plan

Ethical use of HPCs for Bespoke Insurance Policies: Climate-Change and the Future of Property Insurance

This research project investigates the ethical and social implications of employing high-performance computing (HPC) to offer bespoke insurance products using big data analytics. We look at two issues. Firstly, there is a risk to current and future property owners affected by climate change (Cecoo 2022). The project focuses on the interplay between the need for detailed personal data to accurately assess risk and premium cost, the associated risks to privacy, the potential for discrimination, and unequal cost distribution across populations and demographics. The second aspect investigates the social and ethical concerns when actuaries use HPCs to evaluate the risk of insuring properties vulnerable to climate change. The primary function of HPCs is high-speed processing; however, incorporating security protocols might reduce this performance. As a result, users and developers of HPCs may prioritize security only when it does not compromise performance (Guo et al. 2024; Peisert 2017). Therefore, the research also aims to examine the ethical and social issues associated with insurance companies using HPCs to model risks related to climate change. For example, there are concerns about user privacy and the risk of exposing HPCs' security vulnerabilities to malicious actors.

Primary Goal of Project

As climate-change's impact grows, insurers increasingly rely on sophisticated models and HPCs to offer bespoke insurance solutions that reflect the heightened risks to properties, particularly near coastal lines and riverbanks. However, this personalized approach to insurance necessitates access to an extensive range of personal and property-specific data, raising privacy concerns. The increased

granularity of data can also lead to direct or proxy discrimination (Prince and Schwarcz 2020), where individuals in specific regions or from particular demographics might face disproportionately high premiums or even denial of coverage. Additionally, there is a risk of uneven cost distribution, where economically disadvantaged communities may suffer the most due to their geographical vulnerabilities to climate impacts (Best et al., 2023).

Our methodology will include a comprehensive privacy impact assessment to evaluate the depth of data usage and its implications, alongside an analysis of potential discrimination through statistical and machine learning techniques. We will also conduct an economic analysis to explore how bespoke insurance pricing could financially impact different demographic groups, focusing on fairness and equity.

The outcomes of this research will include privacy guidelines that balance the need for data to manage risks with the protection of individual rights, protocols to ensure fairness in insurance pricing, and policy recommendations to prevent the exacerbation of existing social inequalities. Engaging with the concerns of stakeholders—policyholders, advocacy groups, industry experts, and regulators—will be crucial throughout the research process to ensure that the models and policies developed are socially acceptable and ethically sound.

By addressing these critical issues, the project seeks to guide the actuarial industry toward more responsible use of technology in managing the risks posed by climate change, ensuring that insurance practices do not inadvertently harm the very populations they aim to protect.

Secondary Goal of Project

A secondary but related worry is the deployment of HPCs by actuaries to model risk and assess premiums for property insurance. Many HPC developers and users have to balance security with performance. Thus, we also explore leveraging HPCs and big data in crafting bespoke insurance

policies for properties affected by climate change, focusing on the intersection of performance optimization, security concerns, and privacy risks. As the intensity and unpredictability of climate-related events grow, the insurance industry is and will more so in the future utilize HPCs to develop models that require extensive personal and property data to assess risks and tailor insurance offerings accurately.

However, this increasing reliance on HPC raises concerns. In the pursuit of performance, HPC developers may prioritize computational speed and efficiency over the security of the systems, potentially compromising the integrity and confidentiality of the sensitive data processed. This trade-off becomes particularly problematic as insurers use HPCs to handle private information to develop personalized insurance solutions. The dual pressures of managing vast amounts of data quickly and securely pose a real challenge, especially when the data involves personal identifiers that, if mishandled, could lead to severe privacy breaches, financial harm, and discrimination.

We will analyze HPC in the actuarial sector and assess the potential vulnerabilities arising when performance is prioritized over security. We will also examine how these security concerns intersect with privacy issues when developing bespoke insurance products. The project will propose models for balancing performance, security, and privacy, including implementing robust security measures while staying mindful of the need for computational performance.

We aim to develop guidelines for the ethical use of HPC in the insurance industry that consider the security of the computational processes and the privacy of the individuals. Additionally, we will draft protocols and recommendations for industry-wide standards that ensure a secure, fair, and transparent approach to using HPC for risk assessment and insurance product customization.

Similar to the primary concern, by engaging with the concerns of stakeholders from the HPC development community, the insurance industry, cybersecurity experts, and regulatory bodies, this research will provide a comprehensive framework that addresses issues at the intersection of

technology advancement and ethical responsibility. The goal is to ensure that the actuarial practices powered by HPCs are secure, privacy-conscious, and equitable, thereby protecting individuals and communities from the unintentional consequences of technological exploitation in the face of climate change.

References:

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