AI FOR HEALTHY AGING IN A CHANGING CLIMATE: BUILDING TRUST, RESILIENCE, AND INCLUSION

STATEMENT OF RESEARCH PROJECT

The rapid aging of societies, coupled with climate variability, is creating mounting pressures on financial systems, as longer lifespans, chronic disease, and long-term care needs strain pension and insurance markets while extreme weather events heighten mortality, reduce productivity, and amplify correlated risks to insurers and governments. These twin forces are particularly acute in Asia, where demographic aging and climate vulnerability converge, posing severe challenges to economic and financial stability. Artificial Intelligence offers a transformative opportunity to address these risks by integrating high-dimensional health, behavioral, climate, and economic data, uncovering nonlinear patterns, and generating predictive insights for insurance pricing, pension design, and systemic oversight. Yet current approaches remain fragmented and reactive, underscoring the urgent need for an integrated AI-driven framework to support preventive interventions, efficient capital allocation, and sustainable risk management.

Against this backdrop, there is a pressing need for an integrated AI-driven framework that links health, climate, and financial risks into a coherent ecosystem. This project addresses that gap by proposing the development of a multi-population mortality and health-risk modeling framework that explicitly incorporates high-dimensional climate and economic variables. By estimating historical climate–mortality relationships, we will identify hazard indices that serve as building blocks for a standardized Health Risk Index (HRI). The HRI will provide a quantifiable, comparable measure of risk that can be applied in dynamic insurance pricing, AI-based financial planning, and preventive behavioral interventions. Beyond individual risk assessment, the framework will also establish a data-driven system for managing chronic disease and longevity risk, enabling insurers and policymakers to shift from fragmented, retrospective assessments toward continuous, forward-looking risk monitoring.

Finally, the project situates itself within Asia, where demographic aging and climate vulnerability intersect most acutely. By building a transferable framework tailored to Asian populations, the research will connect public health policy, digital health tools, and financial risk management. The outcome will be actionable insights for designing innovative insurance and pension products, enhancing household resilience, and supporting macro-financial stability. In doing so, this project contributes to both academic advances in AI-based risk modeling and practical innovations in sustainable finance and insurance.

SCOPE OF WORK FOR SELECTED PHD STUDENT

The PhD student will play a central role in advancing the methodological and empirical components of this project. The scope of work will include:.

1. Data Collection and Integration
   - Assemble large-scale datasets spanning climate, demographic, health, behavioral, and economic indicators.
   - Clean, preprocess, and harmonize multi-country data to ensure comparability and readiness for AI-based modeling.
2. Climate-Health Analysis
   - Estimate historical climate-health relationships using advanced econometric and statistical techniques.
   - Construct hazard indices that capture the impact of climate variability and extreme events on mortality and health outcomes.

3. Development of Health Risk Index (HRI)
    - Design and validate a standardized HRI by integrating climate, behavioral, and health risk factors.
    - Assess its predictive power for mortality, morbidity, and long-term care needs.
4. AI-Based Risk Modeling
    - Build and calibrate multi-population mortality and health-risk models that incorporate high-dimensional variables.
    - Leverage machine learning, random matrix theory, and causal inference to capture nonlinear patterns and dependencies.
    - Conduct simulations to test robustness under different climate and economic scenarios.
5. Financial Instrument Design
    - Translate research insights into practical applications, including innovative insurance and financial product designs, risk-sharing mechanisms, and capital market instruments.
    - Evaluate the financial sustainability and incentive effects of proposed instruments under diverse scenarios.
6. Dissemination and Scholarly Contribution
    - Prepare research papers for leading academic journals in finance, actuarial science, statistics, and risk management.
    - Present findings at international academic and industry conferences.
    - Contribute to workshops, policy briefs, and collaborative outputs with partner institutions.

Through this scope of work, the PhD student will acquire advanced skills in AI modeling, high-dimensional statistics, climate risk management, and financial risk analytics, while contributing substantively to innovations in sustainable finance, insurance design, and climate–health resilience.