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AI Death Calculator (Life2vec)

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Artificial intelligence (AI) technology in healthcare has made remarkable advancements in recent years, including aiding in diagnosis and treatment, procedural and radiographic augmentation, and assistive functions with tasks such as recordkeeping. One unique application of AI in medicine that has recently garnered media attention is the creation of an AI model capable of predicting mortality. By harnessing the power of machine learning algorithms as applied to comprehensive patient datasets, Life2vec has the potential to provide accurate predictions about an individual's mortality.

Life2vec, a collaborative team of scientists from the Technical University of Denmark, IT University of Copenhagen, and Northeastern University, published an article titled "Using sequences of life-events to predict human lives" in *Nature Computational Science* on December 18, 2023 (Savcisens et al., 2023). The study utilized a database of approximately six million Danish residents between 2008 and 2016 and included a filtered registry of 3,252,086 people between 25 and 70 years old. The model inputs included labor data such as salary, pensions, occupation, location, and hours worked, as well as health data such as World Health Organization (WHO) diagnostic codes, urgency, and hospital admissions. The model demonstrated 78% accuracy in predicting mortality over a four-year period, surpassing other methods, such as actuarial life table and other machine-learning tools (Leffer, 2024). A product of the study, the 'AI Death Calculator' was released for public consumption on December 20, 2023, and functions like a chatbot.

The Life2vec model employs an innovative machine-learning based approach for predicting individual mortality that is a potential disruptor in predictive analytics and has implications beyond mortality prediction and actuarial sciences. One additional application the authors explored is a prediction of personality characteristics, such as introversion vs. extraversion. The other plausible applications are vast. Within healthcare, potential applications include epidemiological studies. Within the public health sector, aging research, personalized medicine, insurance underwriting, and pharmaceutical research. Beyond healthcare, similar machine learning models could be applied to any sector, for example, financial credit risk, preferences for entertainment, personality assessment, human resources practices, and marketing, specifically customer behavior analysis. The utilization of novel advanced machine learning algorithms to analyze life-event sequences holds the potential to revolutionize these sectors and many more.

Given this is a new and rapidly advancing technology, the full impact on consumer markets is unknown and difficult to predict. Factors affecting market integration include data sharing, privacy laws, ethical standards, and consumer acceptance (Basheer, 2023). Sharing of the Life2vec algorithm and dataset has been limited due to Danish regulation and stringent European Union privacy laws, stunting its broader adoption. In addition to regulatory limitations on data sharing, the absence of central databases across the globe will impede certain applications depending on the market sector and geographical region. While highlighting the potential of a large dataset, the creators stress the need for transparency, interpretability, and ethical AI use, particularly in the U.S. (Tyrangiel, 2024). Balancing advancement with privacy rights and ethical standards remains crucial in ensuring the responsible application of these predictive models. Health insurance reform only recently prevented pre-existing conditions from

being used by insurance companies to deny coverage or charge higher prices, but these conditions are still considered when determining life insurance premiums. Similarly, there will be extensive ethical and regulatory discussions regarding the use of AI-based predictive analytics by health insurance companies that may result in discriminatory undertones. The impact of this algorithm on business markets will partially depend on consumer acceptance. For instance, restrictions exist to protect against the use of consumer data for monetization and targeted marketing, and public opinion may influence further regulation. Mortality predictions may impact consumer behavior regarding retirement planning, preventive medicine, and healthcare utilization. By highlighting individual mortality risk factors, the calculator may encourage proactive engagement with healthcare services, fostering increased screening for diseases, regular health check-ups, and better management of chronic conditions, improving overall public health outcomes.

Interestingly, an interpretation of the United Nations (UN) Sustainable Development Goals (SDGs), "a shared blueprint for peace and prosperity for the people and the planet" (United Nations, 2015), might support the use of such technology, specifically related to Goal 3, "Good Health and Well-Being," and Goal 10, "Reduced Inequalities." If the technology were cost-effective and widely available, Life2vec or similar algorithms could predict etiologies of poor health and health inequity to guide region-specific public health initiatives. The Life2vec calculator identified factors associated with early mortality, such as mental health disease, male gender, and having a skilled profession, while longer lifespans correlated with leadership roles and higher income, providing a useful guide for the next steps in health equity initiatives (Buenconsejo, J, 2023). Similarly, regarding Goal 5, "Gender Equality," the technology could focus on gender-specific risk factors and reduce gender disparities in health outcomes. Regarding

Goal 9, "Industry, Innovation, and Infrastructure", certain industrial practices, such as those that expose the environment and populations to nano plastics, have a negative health impact (Hanpeng et al., 2022). One can imagine a technological spinoff of the Life2vec algorithm that links specific industrial practices to health and mortality, guiding best practices and promoting harm reduction.

The Life2vec model and AI Death Calculator are milestones regarding AI-based predictive analytic tools and have the potential to redefine predictive analytics across many sectors. The implications for innovation, consumer commercialization, and societal well-being are vast. As similar technology continues to evolve, it emphasizes the need to balance technological advancement with ethical considerations, privacy rights, local laws, and regulations. The alignment of Life2vec's capabilities with the UN SDGs further highlights the technology's global potential to promote healthy living, reduce inequalities, and foster a sustainable future for mankind.

The authors have no conflicts to report.

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