Leveraging AI for Improved Insurance Product Development

By Dr. Janez Križaj

Professor of Computer Science, University of Maribor (UM)

1. Introduction to AI in Insurance Product Development

Introduction

The insurance industry has witnessed a growing interest in innovations operating within the sphere of artificial intelligence. Although the importance of AI in different areas of insurance is significant, its application in insurance product development appeals to us to a great extent. The rise of AI has brought about changes in terms of speed, efficiency of calculation, decision-making processes, and most importantly, the paradigm of the insurance industry from product orientation to customer orientation, ultimately bringing about innovation.

The change started with the advent of machine learning algorithms, especially deep learning, in the insurance product sector. These algorithms provide an opportunity for the insurance industry to examine a substantial, heterogeneous data collection. As a result, they are perceived as sophisticated instruments that not only identify patterns in massive quantities of raw data but also recognize the real requirements, expectations, conduct, fitness, and disposition of the insured, prospects, and corporate clients in light of various practices, alternatives, technologies, and strategies in insurance. Artificial intelligence embodies machine learning and deep learning, as well as other significant transformers such as robo-advisory, data analysis, and blockchain operations. The objective of the present essay is: i. To map the transformation made by AI towards product design and delivery ii. To understand the market requirements of product design and delivery in the insurance sector iii. To study the realization of market demand, AI in product design and development in European insurance. iv. Recommend strategies and takeaways for practitioners in Europe regarding AI usage in decision-making for insurance product development. In collecting the information for the building of our theoretical discussion, we adopt a multidisciplinary approach.

1.1. Overview of AI and Machine Learning

1.1. Overview of Artificial Intelligence and Machine Learning Artificial Intelligence (AI) is a collection of technologies that allow machines to perceive, act, and learn, in addition to conventional computing technology. Machine Learning (ML) is a subset of AI that employs computers to learn from data. AI includes various technologies such as knowledge representation, logical reasoning, pattern recognition, and understanding; ML is a subset that utilizes various algorithmic approaches to allow machines to learn from data represented as instances that comprise features describing the instance and the corresponding outcome, such as fraud or not fraud. Insurance can use AI and ML when converting natural language text to structured meaning, called natural language processing. The use of AI and ML creates the capability of near actual understanding of a text's information compared to previous application methods for underwriting, claim adjudication, fraud detection, and customer inquiry. This application capability leverages unstructured and semi-structured data from new sources, creating domain data agility and leveraging the advantages of big data generated outside the company.

The history of AI and ML has been previously described, with each field having its ebbs and flows of popularity. Over the past few decades, AI largely operated using expert systems, regardless of whether the AI operated in an organization's basement or in the present public cloud; it was not until the beginning of this century that machine learning reached commercial relevance. In this section, we will focus mainly on the concepts behind these advanced technologies and try to keep the equations to a minimum. It is important that we all understand these fundamentals as the following sections will go into the details of building these models. Importantly, regressions are used in many pricing engines because they can define the relationship between a company's underwriting appetite and their corresponding underwriting criteria; for instance, we can use regressions to define a linear relationship between loss ratio and credit score. The first step in every model prediction is to utilize carefully prepared data to ingest many historical outcomes that include our features.

2. Market Analysis and Needs Identification

Before developing an insurance product, insurers need to know the pulse of the market. Market analysis aims to comprehend the product environment by examining customer needs, expectations, and purchasing behaviors. Through market analysis, insurers can increase the

relevance of insurance products offered with market demands or future opportunities. There are initiatives currently around innovative health insurance products that better fit today's workforce. Both market analysis and market needs are important after launching a new insurance product. An insurer can make strategic decisions based on the results of these studies. As part of market analysis, insurers may replicate some or most of the needs analysis that was done to initiate this unit to assess customer needs and trends to develop an appropriate insurance product.

A market analysis is broadly conducted using a variety of methodological approaches and techniques. A market analysis may use search data, social media insights, consumer surveys, interest rates, and insurance uptake. However, the strengths and weaknesses of current techniques are the traditional market analysis that relies on structured data, which are processable with classical statistical approaches like frequency distribution, percentages, averages, and many more. In contrast, unstructured outlook allows the forecasting of customer expectations or needs more deeply, online and automatically, than structured data. The spread of unstructured information on the Internet is much higher than structured information, making the conclusions from unstructured data more general and valid. Artificial intelligence is the main technology that can be capable of processing or interpreting unstructured big data resources into human-readable conclusions.

2.1. Data Sources for Market Analysis

Traditionally, insurance companies have conducted market research using surveys, interviews, focus groups, and public reports. They have aimed to gather insight on demographic segments, consumer behavior and attitudes, and product uptake within an area. With the rise of digital technologies, especially social media, mining the online world provides rich insight into customer interactions and expectations and is viewed as holding valuable customer information. Insurance companies are capitalizing on the use of the internet and digital platforms to connect with consumers and gather customer opinions on these platforms. Customers are making decisions to improve their everyday lives based on peer-to-peer reviews and service standards, so gathering data from social media is vital to understanding the customer's changing requirements. Market analysis helps identify problems and opportunities and has recently evolved data sources, which allow businesses to understand

their evolving ecosystem, i.e., service user demographics when there is a life event, delivering an instant opportunity. Ethical considerations and observational user data application are becoming significant topics in the digital world, with the advent of AI-fueled solutions. As data from different sources begins to be integrated to provide rich human-centric service insight, solutions like AI are able to connect the dots with many different data pipelines, giving a much broader and holistic view of the market offering. AI can quickly scrape and clean data, combining the data into a sanitized, ethically relevant data cube in minutes. Data accuracy and what the end projects require to produce as an output are key; overhead and the data selection process are vital in AI approach. Data analysis is also key to determining customer behavior as opposed to just collecting lots of unethical data.

2.2. Machine Learning Algorithms for Market Needs Identification

Market needs identification is a core step in the new insurance product development process. The identification can be efficiently done with the application of several machine learning techniques. In this section, we present how classification, regression, and clustering algorithms can bring different insights into consumer behavior. Prediction results of the algorithms are viewed as a form of predictive analytics that could yield trends and collective customer demands relevant for product design. Given the growing importance of personalized finance, two examples demonstrate the potential of these machine learning algorithms in identifying different consumer segments and their distinctive needs.

The application of a wide array of machine learning algorithms for market needs identification is aimed at creating a tailored insurance product capable of satisfying the needs of a large potential customer base that traditional market analyses have been unable to capture. These techniques can be employed effectively to identify market needs and tailor-made insurance product design. For the insurance industry, market segmentation is possible; customer needs are changing; market needs identification in a new insurance product can help create differential insurance products; and time demand can be predicted. One challenge related to the identification of market segmentation is selecting the right algorithm that could reveal some insights. Moreover, interpreting which input data could form a conclusion about customer segments is not straightforward. AI has the advantage of more accurate and efficient choices to analyze the market, thus not only creating new but also objective views of market

analysis. With the development of big data, AI is expected to not only look at the market from a segment point of view but can also be personalized.

3. Designing Competitive Insurance Offerings

Designing competitive insurance offerings requires a thorough understanding of customer needs contextually and in-depth knowledge of product preference. Insurance is a highly personal, preference-driven product. One-size-fits-all approaches are bound to fail in this industry. Thanks to AI, we can now personalize our insurance products based on individual customer profiles that include attributes and parameters beyond just age, gender, and location. This has far-reaching implications and can give insurers a sustained competitive edge.

AI technologies allow us to dive deep into analyzing structured as well as unstructured data to extract critical insights that help design competitive products. Do insured individuals prefer a faster claims settlement process over the amount of the claims settlement? Do they prefer high insurance amounts to cover risks, or would they rather pay a lower single premium? Insurers can also solicit customer feedback on product features and peripherals before launching the product through a sandbox environment with a selected group of their customers. Based on feedback data and the log data generated during the interaction with the sandbox, the processes can be further refined. Product design should be an agile process that can constantly evolve using data-driven insights. By leveraging AI algorithms, insurers can recommend new product features and ensembles, user stories, and release plans. Additionally, they can also optimize product bundle generation and simulate its impact using analytics.

Combining various features and calculating the expected impact as well as a response to those features is a complex task that AI, using cognitive reasoning, can handle well. Insurers have the added advantage of partnering with tech vendors who can enable innovative product features or peripherals that can help in increasing customer interaction and the stickiness of the insurance product. Use cases range from providing preventive health tips to policyholders of health insurance, incentivizing desirable customer behavior through reward point systems, and providing additional services such as alternate job search or job interview scheduling wherein an insurance customer has lost his or her job. This technology can also be used to

assess the impact and value of every permutation and combination of product features and customer segments, thus making the process of agile personalization increasingly efficient and effective. Finally, the increase in data, the evolving regulatory mindsets, and the use of AI generate some challenges in terms of data, privacy, and regulatory compliance. It is very important to strike the right balance between personalization and regulatory compliance by design and say 'privacy by design' and only provide personalized insurance products that make a real difference for the consumer.

3.1. Personalization and Customization in Product Design

Contemporary products created for teamwork and collaboration, professional development, and impact use advanced technologies such as artificial intelligence and machine learning, among others, that anticipate users' needs or adapt to technological changes in real time. As such, these products do not just serve a collective end but engage the individual preferences and capabilities of each user. Similarly, insurance products must do more than compensate for loss. They need to support the 'user experience' of their policyholders. Policyholders demand easy and user-friendly insurance products, often tailored to their personalized needs, in which transparency and proactive risk prevention take center stage. Some examples of insurance products that engage with end-users individually include:

- Health insurance programs that tailor benefits to the customer's lifestyle or weekly activity; - Retirement and pension planning that automates personal budgeting based on individual spending habits and savings rates; - Risk-sharing platforms for freelancers and small businesses that pre-approve health and dental claims based on historic healthcare costs; and - Business interruption insurance that uses real-time data to offer price plans based on the user's risk profile.

The development of these personalized and customizable insurance options is where insurance carriers and insurtechs are concentrating efforts. While insurance carriers have data, technology, and resources, it is often difficult for them to streamline these capabilities so that they can adapt quickly to a customer's unique characteristics by developing new products or modifying existing insurance products accordingly. Moreover, while personalization and customization are key drivers, they also need to take into consideration the ethical implications and be transparent about why each coverage is included or excluded from an

insurance policy. Additionally, enabling data-driven personalization in product development means that insurers have to be proactive in their customer relationships, as insights gathered from real customer pain points can lead to improvements in future product iterations. Having an open customer feedback channel and a user-friendly interface that highlights the insurance policy in general terms and detailed composition fosters better customer relationships.

4. Case Studies and Practical Applications

Numerous analytics indicate that the incorporation of AI and data analytics into various aspects of the insurance product development process is profitable. However, the case in the finance or insurance industry often appears abstract. This part discusses various case studies and practical applications of incorporating AI and data into insurance product development. Spending on AI in Northern Australia may lead to better advice, improved service delivery, and significant financial benefits for commercial insurance customers. While this research is not directly linked to the insurance industry's AI, it provides a clear policy context for transforming the potential AI investment into cash savings.

In an AI-to-the-core initiative, Munich Re has co-developed a data-driven methodology that determines defendant anticipation by assessing the fluctuations in the asset dynamics between the losses and the monitoring mutuals' portfolio. This risk formula enables the monitoring mutuals to effectively identify, select, and segment risks to achieve the loss ratio and insurance coverage of goals. Another application of AI is the massive back-office activities related to market research and comparisons. For example, Kvika worked with AI to sift information from its extensive database of large numbers of real estate transactions in Iceland and provide in-depth market insights and forecast planning. The forecast includes future demand for permitted real estate loans. As a result, Kvika also designs new financial products to help young individuals and organizations take advantage of the system.

Länsförsäkringar has introduced dynamic and customized home insurance into Swedish homes. When developing a product that differs from existing ones on the market, the company was in a challenging environment where behavior and risk were previously unknown. In addition to traditional interviews and surveys, Länsförsäkringar has chosen to use AI to better understand customer needs, improve communications, and design products

that better fit the market. Several strategic analysis projects have been carried out with a focus on innovation, customer needs, and customer communication.

4.1. Real-world Examples of AI-driven Product Development

4.1. Real-world Examples of AI-driven Product Development

Several insurance companies across the globe are implementing AI technologies to enhance product personalization, testing, and customer experiences during the product development process. A company has built customer market segments for its cashless insurance using unsupervised machine learning algorithms. These segments are now used to pilot personalized debt and contingency product offerings to different groups of policyholders. Another company has collaborated to build a first-in-market typhoon insurance product for small businesses. A firm tested various versions of a package cover for farmers with individual smallholder policies, and companies have utilized collaborations to bring products to market, cutting through financial inequality in Latin America. A technology company is improving its pricing and underwriting for homeshare, peer-to-peer, and short-term rental insurance products using various machine learning methods. Most collaborations, especially those that involve AI capacity from insurtech, regtech, and other ecosystems, have resulted in products and services that are first in market, and competitors are following the pack.

Several of these businesses piloting AI-enhanced products or services have also reported significant improvements in their ratios. One company has recorded a 14% improvement in their retention rate for policies sold to gig workers that are personalized using big data and AI. Another company has analyzed thousands of customers buying typhoon insurance for small businesses in the first month and claimed a significant amount of market share, reaching more than 370 customers despite little in the way of formal promotion. In several different pilot projects for corporate customers, a firm has sold an average of over 40% of the potential insurance products proactively to smallholder farmers. A space agency has reported a tenfold improvement in an already record retention rate for member companies interested in using space for business thanks to risk analytics. In a number of these examples, AI is a part of the process to streamline the underwriting. Alone, it cannot create the product and has deficiencies in the underwriting factors since risk segmentation can be inadequate. But AI, in the form of alternative or non-traditional data sources and distribution channels, can provide

valuable insights to improve traditional underwriting for the insurance process or for product development. More importantly, by collaborating with multiple teams in the use case of market prediction, such as advertising and communications, information systems companies can enter an even broader ecosystem that can improve customer experiences, operations, and technology for diverse customers.

5. Challenges and Ethical Considerations

However, it is important to consider several ethical issues. First, AI tools are reinforced with the patterns and assumptions that they are learning from. For instance, this can lead to biases in algorithmic predictions between different customer segments. This can be particularly true if AI tools are to automate the insurance product development or claims process. Different data sets include different types of individuals, so technology can learn to predict different divisions based on historical bias, which is most likely to be ingrained in data. Insurers can be seen as unfair in the products sold or how claims are treated. As the adoption of AI in insurance and management becomes more widespread, greater transparency is required.

Second, one ethical issue about AI-based tools used in product development and insurance management is the need to generate and optimize retention of predictive models. AI tools need data, including sensitive data, to create accurate predictive models. But this requires ethical and regulatory constraints in terms of data protection to be taken into account at this stage. Finally, AI modeling raises accountability issues. An AI system that uses an automatic decision process with specific potential can never be fully accountable. However, professionals in this area, both in ethics and compliance with regulatory requirements, demand that the decision-making process, which is becoming increasingly complex through the use of AI, be transparent. This is intended to ensure data privacy and can be considered as part of a corporate or internal risk assessment framework to ensure product development and insurance processes are in line with internal standards and ethical principles.

5.1. Data Privacy and Security Concerns

In the data-driven future envisioned by AI proponents, insurers would not only collect policyholders' data but also analyze it and engage in known and unknown use cases of such valuable personal information. Sharing a multitude of non-anonymized customer

transactional data for the development or validation of an AI algorithm poses heightened risks. Additional care must be taken to ensure that such personal data stored for the purpose of subsequent AI analytics complies with greater legal requirements than data used for mere claims management, for example, for the development and offering of new products. Breaches of data, whether through unsanctioned access or cyber intrusions, can have severe repercussions on an agency, leading to loss of customer trust, negative publicity, and potential ramifications from both affected customers and regulators.

In legal terms, data privacy is an expectation from all individuals that their personal information will be handled in a way that is respectful, appropriate, and confidential. Strict regulatory compliance with data protection in the insurance sector is required to protect customer data against data breaches or bribes of anonymous data offering certain re-identification risks. Furthermore, insurance companies are required to employ organizational and technical measures to guarantee the cybersecurity of their sensitive networks and information systems. To address such requirements, insurers need to build internal data security capabilities, including aware employees as one of the key shields to prevent human-related data leaks. It is, thus, essential that a data privacy culture also exists internally, and in such instances, customers could be informed of the planned use of their data. Ways to develop such a company culture can include internal processes, internal training, and data privacy guidelines. Informing the customer, also known as being transparent by design, can align with contemporary developments in the legislative requirements around data, which tend to result in insurers' obligations to inform the customer about the collection and use of their personal data.

6. Future Direction

There is no doubt that in the coming years AI will touch every corner of insurance product development. The future of this expanding technology is backed by more than 30 percent uptake and considerable planned investment in the AI space by global insurers. Insurance, automotive services, supply chain and logistics, and auto/property claims in the USA and Canada have adopted AI for some form of service. It is expected that the global value of AI for insurance will increase to over $40 billion by 2027, initially estimated at $1.3 billion in 2018.

The predictions are that AI is expected to transform product ownership models and fundamentally alter insurance.

The comprehensive applicability of this disruptive technology is yet to emerge, but the fundamental advantage of being able to access and process copious quantities of data is swelling the volumes and flow of information between insurance companies and their customers. It is anticipated that one potential synergy will be the merging of AI and blockchain by permitting verification of transactions in real time with unfalsifiable records. The blockchain is said to increase technological transparency, which may partly alleviate the technology's "black box" qualities that may be a barrier to consumer confidence. It is suggested that we will see the evolution from product underwriter to situational underwriter, with pricing based on the probabilistic predictive potential of each insured individual throughout their entire policy.

Technology providers and insurers alike are slowly opening the door to an adaptive form of insurance. This type of insurance offering understands both the customer and the risk better and will position insurance companies to provide more agile responses. This new approach will leverage AI and machine learning combined with vast data pools in new ways in the future using parametric trigger concepts. Although insurers are faced with barriers to adoption, including regulatory approval, demand for innovation and profits are two key motivators for the insurance industry transforming, investing, and adopting adaptive capabilities. Most experts suggest that the incumbent insurers must work with or compete against big insurtech as technology and collaboration between established insurers and disruptive startups are set to dominate the future of insurance.

Although 22 percent of experts suggest that insurtech will be joined by the tech giants, 50 percent believe the future competitive landscape is too hard to predict. The growth of AI technology is also met with apprehension. It is envisaged that allowing technology to make decisions in liability insurance has ethical risks and will promote endless litigation. One expert suggests that AI will automate claim decisions in the long term. This will involve numerous regulatory changes to accommodate such a new business model. This also creates a nightmare of unintended consequences. Liability insurance may become unnecessary if injured persons can request a legal court review of the AI decision free of charge. Other barriers to AI in

insurance include the rapid rate of change in our global economic and geographical environment, which is creating insurance products that are too expensive and unable to be sold economically. Globalization, changing demands, and economic trends may shift the economic balance of the insurance industry to concentrate on different policy types and change the requirements for insurance services in the market.

7. Conclusion

The modern insurance environment is one of rapidly-evolving ecosystems and renewed potential. Today's insurance world is no longer a bastion of demographic or geographic segmentation, but rather, of Artificial Intelligence and next-generation transformation. It is the vital driver of a new digital approach in insurance that offers automation and optimization, the freedom to reduce the focus on repetitive tasks and to shift focus to value creation. There, then, lies the potential of improved operational efficiency and profitable growth conduits.

It is also an engagement surrounding a mandate for a customer-centric understanding to offer improved personalized solutions to unique demands. Effectively, this next move will see customers involved in enhancing product design and driving meaningful personalization. And, once again, the key to achieving that is through increasing reliance on Artificial Intelligence capabilities to facilitate the sort of granular understanding that can develop and deliver the required products. The insurance industry must, however, work to overcome the perceived and very real barriers of suspicious customers, issues of data protection and ethical considerations.

The future is clear, we must build fair, ethical, and privacy-respecting AI into the very core of insurance product design. In the insurance market, case studies exploring this very path have displayed huge benefits therein. A market-wide adoption may be the only possible and efficient response required to stay competitive. The AI of tomorrow promises to be intelligent, fair, transparent, private, efficient, and explainable, and insurance will evolve to do more to enhance the lives of its policyholders, mitigate everyday risks into simple problems to troubleshoot and solve. In the AI-driven insurance world of tomorrow, the innovative broker, MGA, and carrier leaders of today are moving to integrate carefully and to improve the value they give through partnerships. For the customer, AI insight secret agents have a way to

transform and improve the way they perform insurance policies, adding value to both the insurer and the policyholder. The speculative trend is fascinating and filing the truly innovative insurance product room.

Reference:

1. S. Kumari, "AI-Driven Cloud Transformation for Product Management: Optimizing Resource Allocation, Cost Management, and Market Adaptation in Digital Products ", *IoT and Edge Comp. J*, vol. 2, no. 1, pp. 29–54, Jun. 2022

2. Tamanampudi, Venkata Mohit. "Automating CI/CD Pipelines with Machine Learning Algorithms: Optimizing Build and Deployment Processes in DevOps Ecosystems." *Distributed Learning and Broad Applications in Scientific Research* 5 (2019): 810-849.

3. Machireddy, Jeshwanth Reddy. "Data-Driven Insights: Analyzing the Effects of Underutilized HRAs and HSAs on Healthcare Spending and Insurance Efficiency." Journal of Bioinformatics and Artificial Intelligence 1.1 (2021): 450-470.

4. J. Singh, "The Future of Autonomous Driving: Vision-Based Systems vs. LiDAR and the Benefits of Combining Both for Fully Autonomous Vehicles ", *J. of Artificial Int. Research and App.*, vol. 1, no. 2, pp. 333–376, Jul. 2021

5. Tamanampudi, Venkata Mohit. "AI and DevOps: Enhancing Pipeline Automation with Deep Learning Models for Predictive Resource Scaling and Fault Tolerance." *Distributed Learning and Broad Applications in Scientific Research* 7 (2021): 38-77.

6. Ahmed Qureshi, Hamza, et al. "The Promising Role of Artificial Intelligence in Navigating Lung Cancer Prognosis." International Journal for Multidisciplinary Research, vol. 6, no. 4, 14 Aug. 2024, pp. 1–21.

7. Singh, Jaswinder. "Deepfakes: The Threat to Data Authenticity and Public Trust in the Age of AI-Driven Manipulation of Visual and Audio Content." *Journal of AI-Assisted Scientific Discovery* 2.1 (2022): 428-467.

8. Tamanampudi, Venkata Mohit. "Autonomous AI Agents for Continuous Deployment Pipelines: Using Machine Learning for Automated Code Testing and Release Management in DevOps." *Australian Journal of Machine Learning Research & Applications* 3.1 (2023): 557-600.