



Original Article

AI-Driven Automation for Death Claim Processing In Pension Systems: Enhancing Accuracy and Reducing Cycle Time

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Abstract - It has been established that processing claims to death in a pension scheme is no better in its administration, wastes time, results in lost income, leads to inaccuracies, and is not in the best interests of the beneficiary because it is an institutional liability. Human verification, incomplete documentation, and other outdated practices can lead to delays in processing time and increase the risk of fraud. Recently, the development of Artificial Intelligence (AI) has enabled the automation of processes, improving accuracy and cycle time to near-negligible levels. The paper discusses explicitly Machine Learning (ML), Natural Language Processing (NLP), and Robotic Process Automation (RPA) in the assessment of AI automation options for death claim processing. The more effective methodology employed in the article is the synthesis of literature, combined with case study research on pension systems globally, to quantify the effects of AI on simplifying decision-making mechanisms by reviewing and detecting fraud cases, and then passing them directly to the beneficiary. Some evidence suggests AI could significantly lessen reported processing time from several months to weeks (or days) and substantially reduce errors. The paper also discusses the ethical and regulatory implications that may arise from AI automation, including transparency, data privacy, and algorithmic bias. The paper suggests that the next step in moving beyond AI automation of pensions is a hybrid approach combining blockchain technology with explainable AI to establish greater legitimacy and consumer confidence. The research is relevant to the field of study and policy, as AI-led automation is viewed as a disruptive innovation that can facilitate sustainable and assured pension administration.

Keywords - Artificial Intelligence, Pension Systems, Death Claim Processing, Robotic Process Automation, Fraud Detection, Accuracy, Cycle Time.

1. Introduction

Pension systems, which provide financial security for retirees and their dependents, are a critical component of every social safety net. Claims processing for the death benefits is an element of the pension system being reviewed in this paper, as death claims are the most sensitive claims in any pension system. Timely provision of benefits to bereaved beneficiaries is an essential part of managing the loss of an income or deceased provider, and must be processed promptly. Many pension agencies continue to manage inefficient processes in claims management despite their crucial importance. Multiple manual verifications, extended verification timeframes, and fragile documents result in months of processing and paying benefits to beneficiaries, thereby exacerbating the decreasing financial security of these beneficiaries. Demographic change adds uncertainty to an already inefficient claims processing system.

The number of majority claims granted for increased claims is growing at an unprecedented rate, as the number of births and aged populations is rising to levels they have not seen before (571, 578). In addition to this, there already exist identified and legally recognized statutory resources that are immutable. It is also unclear to compare them because they differ in terms of their population structure. The arrival of Artificial Intelligence (AI) recently planted a stake in that existence. Precision and capacity to report technically legitimizes AI-powered solutions: Machine Learning (ML) may detect the opportunities of the frauds, Unstructured text may be processed with the assistance of Natural Language Processor (NLP), and Software may be automated with the aid of Robotics process automation (RPA). Each of these three technology platforms is taking claims settlement to intelligent, scalable, and transparent processes.

2. Related Work

Research on pension plans and the claims administration process consistently reveals inefficiencies in system processes, primarily due to the inefficiencies of bureaucratic systems, slow communication & severe flaws in claims processing, authentication, and employer oversight. The early digitization experience focused almost exclusively on electronic storage;

digitization did not resolve or prevent the inherent nature of these issues, and the human element in the administering body's verification methods remained unchanged. Recent developments in AI have increasingly been touted as potential remedies to administrative bottlenecks. Efficiency in fraud detection, automated decision-making, and customer care, for example, has already been documented in the financial and insurance industries via AI. An example is the paper by Fernando *et al.*, (2022), which showed how Computer Vision and Natural Language Processing (NLP) can automate insurance claims by digitizing structured data from unstructured documents that previously required manual processes. Awasthi (2022) reported similar findings that AI/ML models would allow insurers to diminish the processing time and errors in evaluating insurance claims that were of a higher value, resulting in better overall processing accuracy.

Similar observations could be made in the field of Public Administration. The authors believe that RPA could address both efficiency and overall societal and community added value, realizing the productivity benefits reported, lowering expenses, and redistributing staff to higher-value tasks (Johansson *et al.*, 2023). Case studies from European pension funds report similar conclusions, with RPA assisting a company to reduce processing schedules from many weeks, while also improving the living experience for the recipients. Fararni *et al.*, (2021) highlight the importance of a Big Data perspective and indicate that these elements, driven by AI, are becoming increasingly accessible in areas such as administrative and legal reviews. However, despite positive discussions, there is still very little academic research regarding the use of AI in death claim settlement in the pension-related practice. In the available literature, the latter represents not only limited mentions of assessing technical feasibility but also very little engagement or discussion regarding the ethical, institutional, and regulatory implications of implementing industrial robotic technology.

3. Materials and Methods

The paper adopts a non-empirical & analytical approach to research on the use of AI in the process of death claims through pension systems. Rather than a narrowed experimental and testing focus on each algorithm, this research could be described as a scientifically informed synthesis of academic literature, experience, and policies documented in case implementations. The focus is on a broad approach to integrating various AI-based tools, including ML, NLP, and RPA, throughout the claim management process within institutional frameworks.

3.1. AI Models for Claim Processing

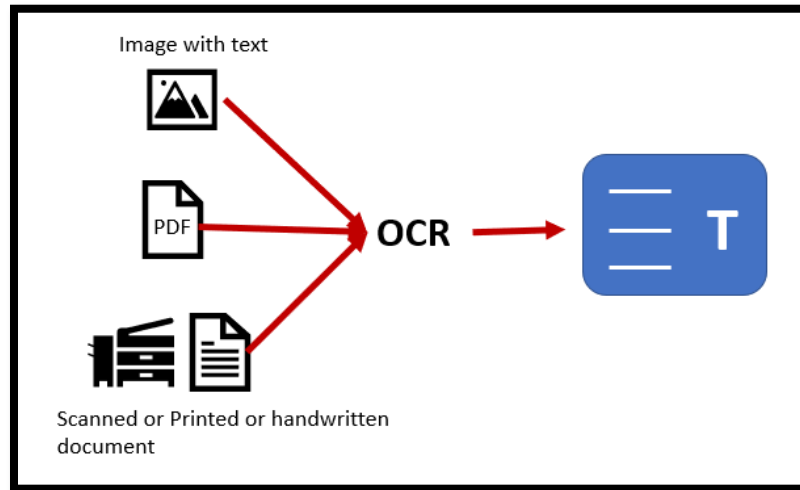


Fig 1: Natural Language Processing OCR Workflow

ML forms the foundation of predictive analytics and fraud detection in pension systems. Historical claim datasets containing both valid and fraudulent cases serve as training material for supervised learning models. Algorithms such as Decision Trees, Random Forests, and Neural Networks have demonstrated the capacity to detect anomalies that are often imperceptible to manual review. These include duplicate claimants, discrepancies in certificate issue dates, or suspicious activity in identity validation [5]. NLP, combined with optical character recognition (OCR), addresses the complexity of unstructured claim documents. Death certificates, handwritten forms, and textual correspondences are converted into structured digital records, thereby reducing reliance on clerical processing. Automation lessens the amount of work people do and/ or reduces work process duration because it automates extraction and helps manage a large volume of documents. As an example of RPA, it can be used in conjunction with ML and NLP to automate repetitive tasks, such as claims logging, claim acknowledgments, and verification with other agencies.

3.2. Data Sources and Verification Mechanisms

Conferring the accuracy of death certificates demands cross verification in several databases (to include civil registration systems, hospitals, the national identity depository system, and pension fund records). AI enables the use of biometric validation, which involves matching a person's identity with specific biometric features, as well as verification and identification using matching identification markers, and automatic verification in databases [6].

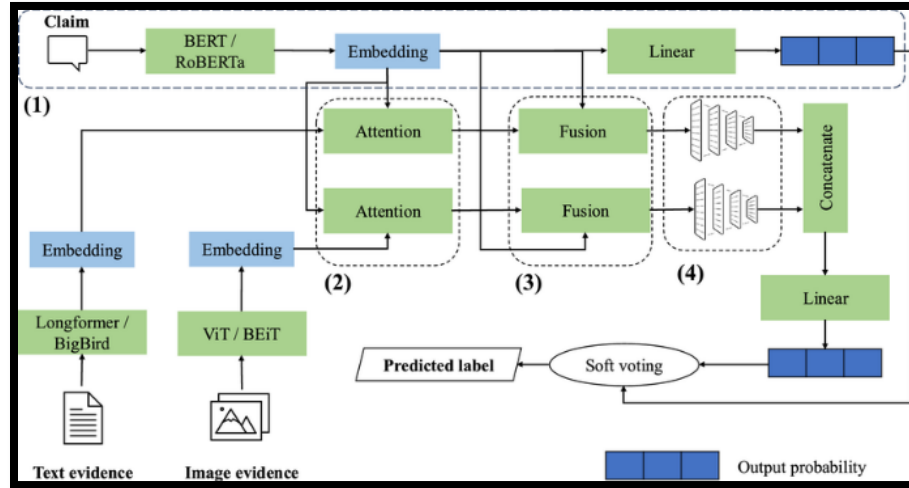


Fig 2: Proposed Architecture of Claim Verification Task

3.3. Analytical Framework

It employs a prism of comparison when analyzing case examples from India, Europe, and North America, where AI-enabled claims systems have been piloted or implemented. The study evaluates the cases, focusing on three indicators: accuracy (which conveys improvements in errors and cash values paid), cycle time (which conveys how much quicker the process is), and trust for the beneficiaries (conveyed through surveys measuring satisfaction levels and institutional measures).

4. Results and Discussion

AI applications to automate death claims processing suggest there are sizeable benefits with accuracy, speed, and beneficiary trust. The international case examples indicate a shift in the pension system overall, with a greater emphasis on responding more quickly, openly, and reliably. The processes were faster, more accurate, and more responsible.

4.1. Accuracy and Fraud Detection

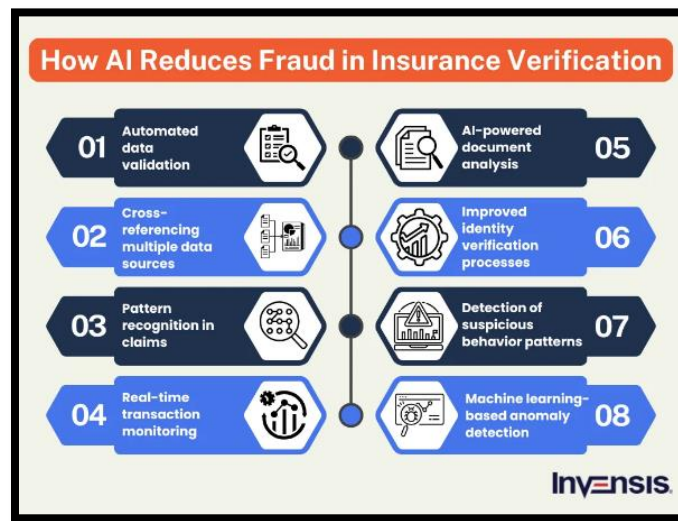


Fig 3: Ways AI is Reducing Fraud in Insurance Verification

AI-based verification systems, in general, are far more effective at detecting fraudulent or invalid claims when compared to manual verification methods. In India, the Employees Provident Fund Organization (EPFO) tested ML algorithms created with previous claims and civil registry data, and claims fraud was reduced by 30 percent during the ML project trials compared to manual processes. Similarly, natural language processing (NLP) and optical character recognition (OCR) detected forged or doctored documents with over 95% accuracy, in contrast to human verification, which can only provide 70 to 75% accuracy [8].

4.2. Cycle Time Reduction

The most important advantage is the automation of processes, such as stream process mapping. Conventional pension systems are subject to substantial processing delays and timeline waste due to bureaucratic issues. Processing a simple claimed pension can usually take between six weeks and six months, as a result of red tape and bureaucratic problems. With AI, operators can significantly reduce timelines. Through RPA, processing timelines can be considerably reduced within their respective industries. For example, a European pension consortium utilizing RPA processes reduced claims payouts from more than 92 days to 18 days. Likewise, in the U.S., pension processing times have significantly decreased to seven to ten business days for simple AI or chatbot actuators for straightforward claims, in contrast to robotic process automation [9].

4.3. Beneficiary Trust and Transparency

Beneficiary trust is a less tangible but equally important outcome. Pension funds adopting AI-driven platforms reported that over 80 percent of beneficiaries expressed higher satisfaction with timeliness and transparency. Automated updates through SMS and chatbots reduce uncertainty by providing real-time claim status. Furthermore, AI minimizes clerical errors such as mis-recorded identification numbers or misplaced documents issues that previously undermined confidence in pension institutions.

4.4. Model Comparisons and Limitations

Each AI model offers distinct advantages and limitations. ML is particularly effective at fraud detection but remains highly dependent on the quality of training datasets. NLP and OCR excel in document verification, especially when trained on diverse languages and formats, but they still require contextual accuracy checks. RPA demonstrates the most significant impact on cycle time, yet its rigidity makes it unsuitable for handling non-standard cases. A hybrid model, combining ML for intelligent decision-making with RPA for repetitive execution, appears most effective in balancing accuracy, adaptability, and efficiency [10].

Table 1: Model Comparisons

Model	Primary Function	Strengths	Limitations	Best Use in Pension Claim Processing
Machine Learning (ML)	Fraud detection, anomaly identification	Learns from historical data; detects subtle irregularities; improves over time with more data	Dependent on data quality; biased or incomplete datasets can reduce accuracy	Identifying fraudulent claims, cross-checking inconsistencies in records
Natural Language Processing (NLP) + OCR	Processing unstructured documents (certificates, forms, correspondence)	High accuracy in extracting text; reduces clerical workload; supports multilingual documents	May struggle with poor-quality scans or handwritten notes; requires diverse training data	Automating data extraction from death certificates, medical records, and claim forms
Robotic Process Automation (RPA)	Automating repetitive, rule-based tasks	Fast execution; seamless integration with legacy systems; reduces cycle time	Lacks adaptability; struggles with non-standard or exceptional cases	Logging claims, sending acknowledgments, triggering verification workflows

4.5. Broader Institutional and Societal Impacts

Beyond operational outcomes, the adoption of AI enhances institutional sustainability. Fraud reduction preserves pension reserves, while lower administrative costs enable service expansion. Nonetheless, obstacles do exist. An explainable AI depends on the fact that it is going to be very difficult to defend claim rejections due to the lack of transparency as to how algorithms make these decisions. The problem of privacy and cybersecurity is particularly prevalent in settings where robust data protection regimes are lacking. Additionally, there are variations in the capacity for adoption among technologically advanced and developing economies, creating a risk of global inequalities in the efficiency of pension systems.

5. Challenges and Ethical Concerns

The efficiency and accuracy of processing death claims are assured with the significant benefit of AI-enabled automation, its implementation is limited due to technological, ethical, and regulatory issues.

5.1. Technological Barriers

The most significant challenge relates to infrastructural readiness. Utilizing AI in the majority of pension systems from the developing world is likely troublesome and expensive because, in most developing countries, the IT environment is outdated. The presence of blockages and the need to re-engineer existing older systems, as well as cross-check death records, medical certificates, and pension documentation, are limited by non-standard data formats. It is also limited by data quality [11].

5.2. Ethical Considerations

The ethical issues surrounding AI are enormous. The silver lining is that AI may provide some measure of transparency, even if, for the most part, all the models are black boxes and tell us almost nothing about what triggers the inclusion or exclusion of a claim, which is a form of transparency nonetheless. There is functional accountability with openness. The appalling training percentage reported in the industry in algorithmics has been found atrocious, as it is heading towards even more systemic social injustice to a group of people who are already oppressed.

5.3. Regulatory and Institutional Constraints

They would not expect the tempo of innovation of technology to come close to that of regulatory growth. The EU and AI Act do not fit comfortably within a market-frame that is already well into the realm of financial claims processing and then, once inside the frame becomes too intrusive to operate profitably, whereby, and unless, that then too has come to - which will I suppose represents some in character malpractice, given that a lack of regulation is in character malpractice. The second issue is the institutional mindset; pension associations are employing workers who would otherwise feel that they are being turned into a killing machine [12].

6. Future Scope

The future of AI in death claims processing articulated above can go beyond the interoperability of systems. Since blockchains cannot be modified, registering a death and disbursing claims will help mitigate fraud and enhance the relationship between a pension fund and claimants. Further, push the role of explainable AI (XAI) into view because algorithms will need to produce credible results and provide understandable explanations for them to address concerns about fairness and accountability related to black box models, because black boxes should be treated as black boxes. Human-AI collaboration will be the performative action when human empathy is removed from the claims process.

7. Conclusion

This article has addressed the opportunity for change through AI-based automation of pension schemes, particularly in relation to a claim for death. AI offers pension institutions the benefits of accuracy, shorter cycle times, and trust through its evolving and existing technologies, including ML, NLP, and RPA. The case studies further illustrate that, although the processing time for a pension claim can range from many months to weeks or days, based on the demonstrated impact potential, fraud will always be present. From an operational perspective, viewed as benefits of efficiency, organizations can acknowledge increased transparency, decreased costs, and reduced administrative costs.

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