

8th Seminar on Current Issues in General Insurance

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Generative AI for Actuaries: Opportunities, Risks, and Insights

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Speaker's Profile



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Senior Tech Actuarial Consultant with more than 30 years of consulting in actuarial and tech domains in USA and India. With a wide skill set, he managed numerous multi-million-dollar international assignments for major insurance companies across the globe.

Professor of Practice at the Center of Excellence in Actuarial Data Science, Sri Sathya Sai Institute of Higher Learning (Deemed University), with several international research publications and book chapters in Actuarial Data Science and frequent presentations at global conferences.

Agenda



1. Introduction

2. Generative AI Fundamentals

3. Opportunities for Actuaries

4. Challenges

5. Case Studies

6. Looking Forward

7. Q&A

1. Introduction

Evolution of Actuaries with Technology



Prescriptive

Systems executed exactly what we coded.

Predictive

Systems learned from data to forecast.



Generative

Systems create entirely new outputs.

Evolution of Actuaries with Technology



Era	Actuarial Practice	Technology	Insight
17th–18th Century	Birth of actuarial science (probability, mortality tables by Halley).	Printing press, early mechanical calculators.	Both built foundations for structured thinking and sharing knowledge.
19th Century	Life tables formalized, insurance spreads.	Industrial Revolution, telegraphs, mechanical adding machines.	Actuaries used improved data collection + calculation tools.
Early 20th Century	Growth of pensions, social insurance; heavy manual computations.	Typewriters, tabulators (Hollerith), first computers.	First “tech leverage” for large-scale risk models.
Mid–Late 20th Century	Transition from manual tables → spreadsheets, stochastic models.	Mainframes → PCs → Excel (1985).	Explosion in efficiency & modeling complexity.
21st Century (pre-GenAI)	Predictive analytics, GLMs, machine learning on claims & mortality.	Big Data, cloud, open-source Python/R.	Actuaries as data scientists, coding in production.
Now: Gen AI Era	Drafting reports, automating docs, conversational modeling, scenario analysis.	Large language models, generative AI, reasoning engines.	A shift from “number crunching” → insight generation & automation of cognitive tasks.

2. Generative AI Fundamentals

Automation vs AI vs Gen AI



Automation

- Takes care of the repetitive stuff so we don't have to
- Speeds up processes and reduces manual effort
- Does exactly what it's programmed to do — reliable and predictable

AI

- Looks at past patterns and tells us what's likely to happen
- Gives predictions, classifications, and numbers we can act on
- Works within clear boundaries — a smart assistant for decisions

Generative AI

- Can actually create new content, ideas, or scenarios
- Drafts reports, simulates risks, or suggests strategies we might not have thought of
- Helps us move from interpreting the past to co-creating the future

Traditional AI = Thinks & decides (answers questions).

Generative AI = Creates (writes, draws, designs, composes).

AI vs Gen AI in Actuarial Context



Aspect	Traditional AI in Actuarial Work	Generative AI in Actuarial Work
Purpose	Analyze insurance, pension, or risk data to predict outcomes and set prices	Create new scenarios, reports, explanations, or simulations based on actuarial inputs
Example Tasks	Predict claim probability for a policyholder- Classify policyholders into risk groups- Detect fraudulent claims	Draft client-facing reports in plain language- Generate alternative risk scenarios for stress testing- Produce training material for actuarial students
Output	A decision or prediction , e.g., “Claim probability = 0.3” or “Premium = ₹12,500”	New content , e.g., “Generate 3 alternative loss scenarios under different economic conditions” or “Explain solvency risk in simple terms for clients”
Data Use	Uses past claims, mortality tables, and financial data to find patterns and improve pricing/reserving accuracy	Learns from actuarial texts, past reports, and models to generate drafts, scenarios, or summaries
Common Models	GLMs (Generalized Linear Models), credibility theory, survival analysis, machine learning classifiers	Large Language Models (LLMs) like GPT for text, simulation-based Gen AI for stress testing, synthetic data generation
Everyday Examples for Actuaries	Predicting motor insurance claims frequency- Forecasting life expectancy- Flagging anomalies in claim submissions	Drafting regulatory filing notes automatically- Generating “what-if” scenarios for IFRS 17- Creating plain-language summaries of technical models for clients or boards

Traditional AI = Improves actuarial calculations and predictions.

Generative AI = Helps actuaries communicate, simulate, and create new insights faster.

Generative AI

Definition:

Algorithms and models that can **generate new content**, rather than just analyzing or classifying existing data.

How it works:

GenAI models learn patterns, structures, and distributions from vast training datasets.

Produce new outputs that resemble their training data (e.g., writing human-like text, creating new images).

Types of Content Generated:

Text (stories, summaries, reports, code)

Images (art, photos, illustrations)

Audio (music, speech synthesis)

Video (animations, deepfakes)

Core Techniques:

Large Language Models (LLMs):
Specialize in generating natural language (examples: GPT series, ChatGPT)

Transformer Models:
A key architecture enabling modern LLMs

Other approaches:
GANs (for images),
VAEs (for data synthesis)

Requirements for GenAI:

Huge, diverse training datasets

Substantial computing power for training complex models

Industry Voices



Dave Cummings

Many companies block AI tools to protect sensitive data, which slows adoption in insurance despite AI's potential.

AI is transformative, but actuarial judgment and human decision-making cannot be fully replaced.

Frank Chang

Dale Hall

Generative AI offers huge potential for actuaries, but it must be used responsibly with strong ethics, governance, and actuarial judgment.

Industry Voices



Mario Wutrich

Actuaries must be able to trust and validate the models they use; my goal is to make AI transparent and explainable.

We are at an inflection point for the actuarial profession — we either embrace AI and machine learning or risk being left behind.

Ronald Richman

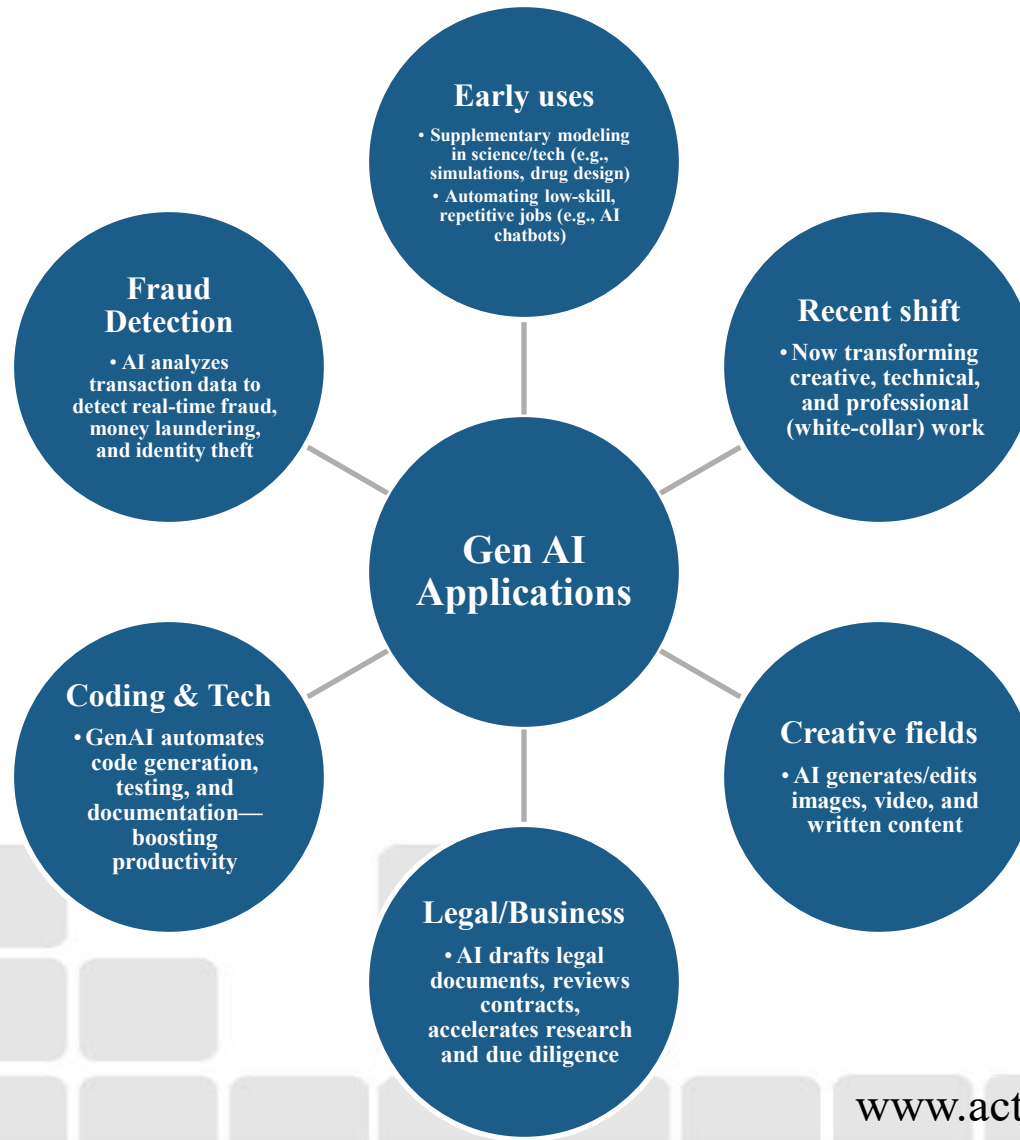
Max Martinelli

Actuaries don't need to be AI engineers; domain knowledge and practical modeling skills are key to meaningful AI use.

3. Opportunities for Actuaries

Gen AI Applications

GenAI's impact is rapidly expanding across industries



Why Gen AI for Actuaries?



Efficiency

automate coding, reporting, and repetitive tasks.

Creativity

produce visuals, explanations, and communication.

Why Gen AI ?

Simulation

generate alternative datasets and risk scenarios.

Accessibility

make actuarial insights understandable for non-experts.

Gen AI Applications for Actuaries



I. Large Language Models (LLMs) – Text & Knowledge

II. Code Generation – Automation of Programming

III. Synthetic Data & Scenarios

IV. Images/Visualizations

V. Forecasting & Time Series Simulation

VI. Agents & Assistants

VII. Speech & Document Generation

I. Large Language Models (LLMs) – Text & Knowledge



Gen AI Tools:

- GPT-4/5 (OpenAI), Claude (Anthropic), Gemini (Google), LLaMA/Mistral (open-source).

Actuarial Uses:

- Bridging data divides by using gen ai for unstructured data.
- Draft actuarial reports, regulatory filings (IFRS 17, Solvency II).
- Generate plain-language summaries of technical models for boards/regulators.
- Create study material, training guides, and exam prep content.

II. Code Generation – Automation of Programming



Gen AI Tools:

- GitHub Copilot, Code Llama, AlphaCode.

Actuarial Uses:

- Writing Python/R scripts for GLMs, credibility theory, survival analysis.
- Automating stochastic simulations and Monte Carlo models.
- Generating SQL queries for extracting insurance datasets.
- Debugging actuarial modeling code.

III. Synthetic Data & Scenarios

Gen AI Tools:

- CTGAN, Tabular Diffusion Models, Gretel.ai, Mostly AI.

Actuarial Uses:

- Create synthetic claims data where data privacy is a concern.
- Generate alternative “what-if” datasets for stress testing.
- Handle rare event modeling (e.g., catastrophic claims, outliers).

IV. Images/Visualizations

Gen AI Tools:

- DALL·E, MidJourney, Stable Diffusion.

Actuarial Uses:

- Designing engaging visuals for actuarial presentations.
- Creating intuitive infographics for risk communication.
- Explaining abstract actuarial concepts (e.g., solvency waterfalls, loss triangles) visually to non-actuaries.

V. Forecasting & Time Series Simulation

Gen AI Tools:

- TimeGPT (Nixtla), DeepAR, Temporal Fusion Transformers.

Actuarial Uses:

- Projecting claims frequency/severity trends.
- Simulating economic scenarios (inflation, interest rates, equity returns).
- Generating future loss ratio scenarios.

VI. Agents & Assistants

Gen AI Tools:

- AutoGPT, LangChain agents, Chatbot frameworks.

Actuarial Uses:

- Act as a virtual actuarial assistant to fetch datasets, run models, and draft results.
- Interactive Q&A for junior actuaries or business teams (“What’s the difference between Chain-Ladder and Bornhuetter-Ferguson methods?”).
- Assist in internal training programs.

VII. Speech & Document Generation



Gen AI Tools:

- Whisper (OpenAI), Speechify, ElevenLabs.

Actuarial Uses:

- Convert actuarial reports into audio briefings for executives.
- Generate spoken training content for actuarial students.
- Voice-enabled dashboards for quick updates on KPIs.

4. Challenges

Gen AI Challenges

Regulatory Attention

Bias and Inclusivity

Quality and Accuracy

Context Awareness

Data Privacy and Security

Copyright

**Auditability and
Transparency**

**Ethical and Moral
Consideration**

5. Case Studies

Use Case - General Insurance Motor & Property

Situation

- An insurer wants to:
 - **Price policies more accurately** (motor, home, property).
 - **Detect fraud** in claims.
 - **Communicate results and scenarios** to management, regulators, and customers.

Traditional AI

Traditional AI in Action

- **Goal:** Improve risk assessment & fraud detection.
- **Method:**
 - Use historical claims, driver behavior, telematics, property data.
 - Apply **predictive models** (GLM, random forests, gradient boosting).
 - Fraud detection with anomaly detection models.
- **Outcome:**
 - “*Premium for this driver = ₹18,000 based on 7% expected claim probability.*”
 - “*Claim X is 85% likely to be fraudulent.*”
 - Better reserving accuracy and risk classification.

Generative AI

Generative AI in Action

- **Goal:** Create narratives, scenarios, and support decision-making.
- **Method:**
 - Use **Gen AI** to:
 - Draft **plain-language explanations** for customers (“Your premium is higher because your driving history shows above-average risk.”).
 - Generate **alternative stress-test scenarios** (“What happens to property losses if cyclone frequency doubles in coastal areas?”).
 - Prepare **regulatory submissions** and board reports automatically, pulling data from actuarial models.
 - Train **customer service chatbots** to answer queries about policies, coverage, and claims in natural language.
- **Outcome:**
 - Transparent communication with policyholders.
 - Faster reporting to regulators.
 - Stronger risk management with richer scenario planning.

Combined Benefit for Actuaries

Combined Benefit of AI + Gen AI

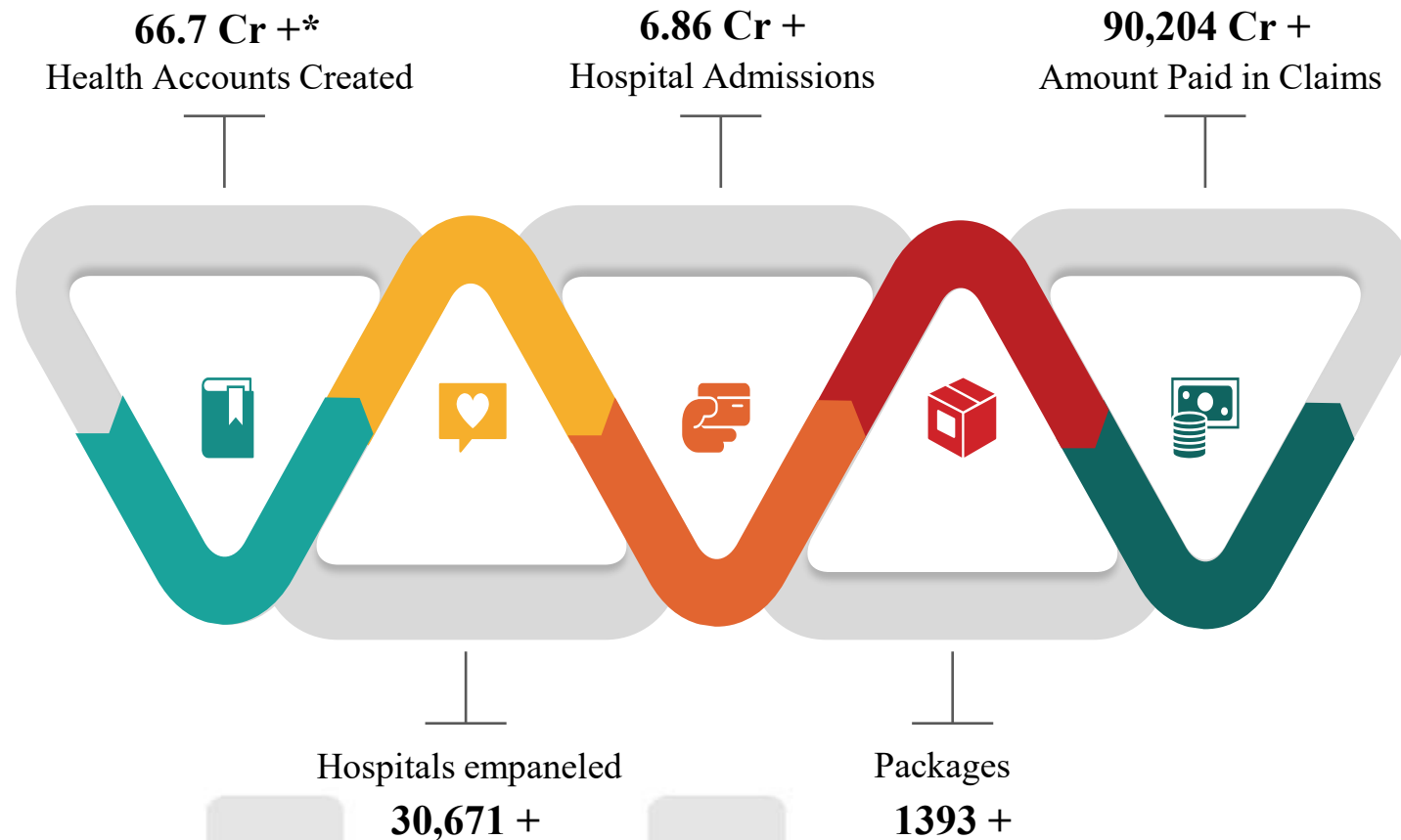
Traditional AI:

**Improves pricing, reserving,
and fraud detection
accuracy.**

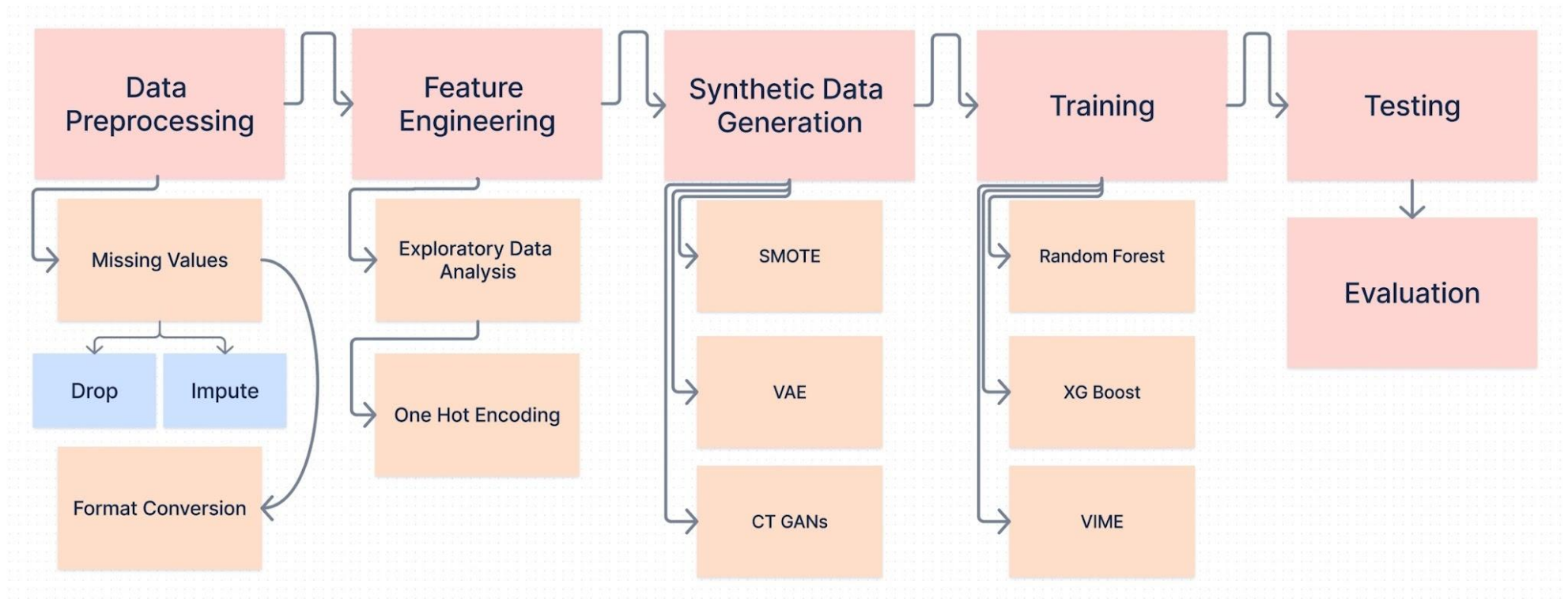
Generative AI:

**Improves explainability, stress
testing, and stakeholder
communication.**

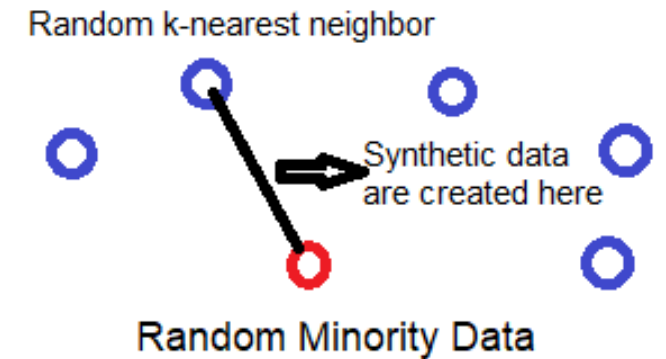
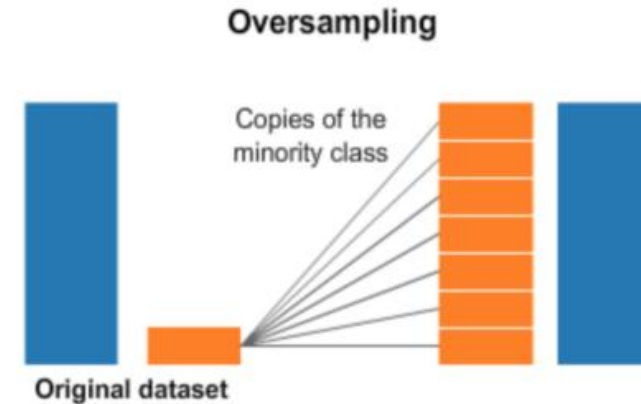
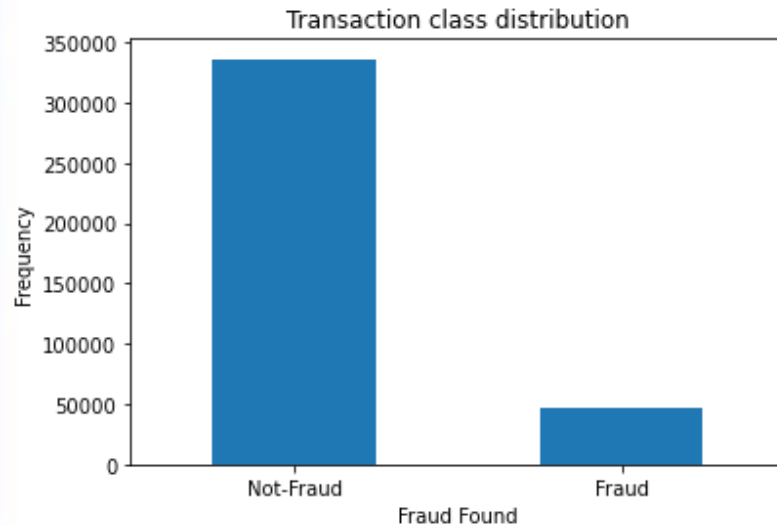
Use Case – Fraud Detection in Ayushman Bharat



Data Science Workflow Adopted

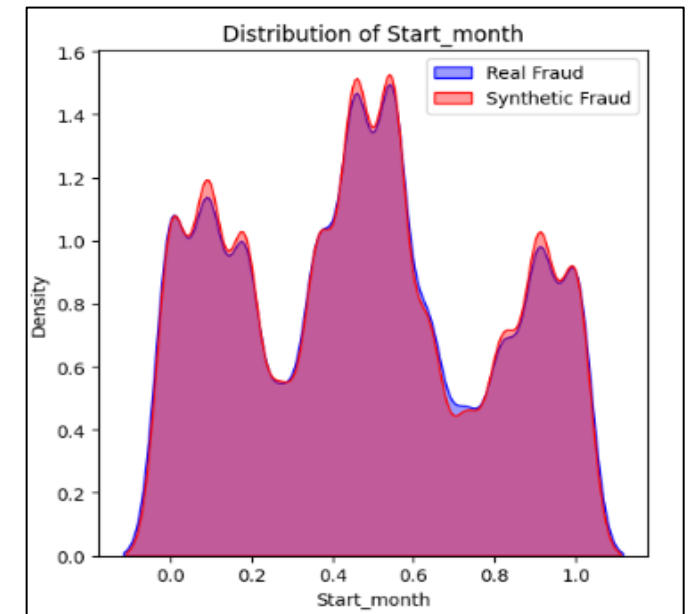
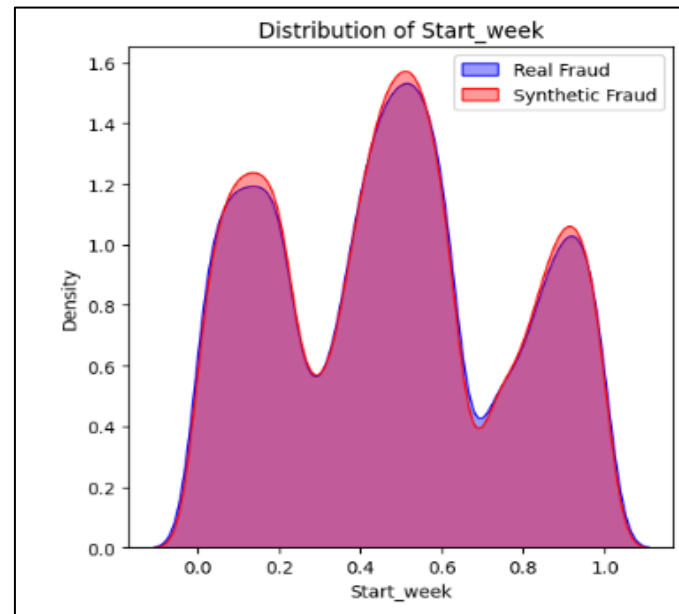
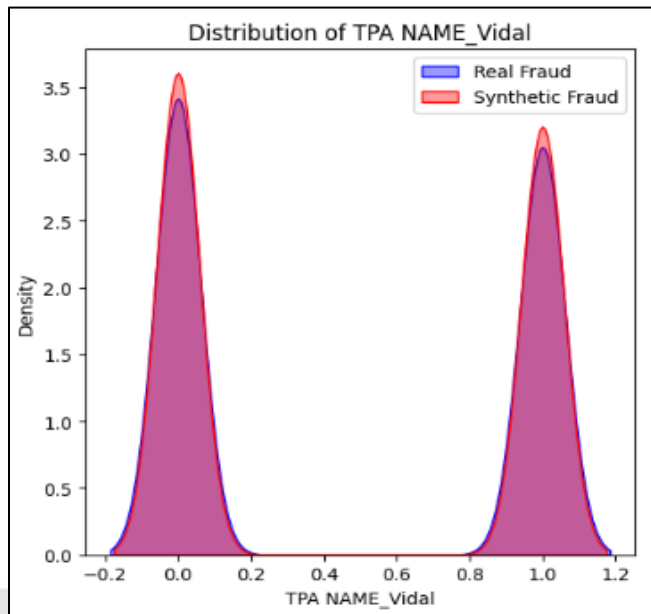


Handling Data Imbalance - SMOTE



Is the generated Synthetic Data reliable?

Yes! We confirmed by plotting their Feature Distributions!



6. Looking Forward

What Next ?

Advancing GenAI Capabilities

- Expect expanding modeling power and specialized actuarial solutions
- Greater accuracy and domain adaptation anticipated

Integration into Actuarial Practice

- Increased adoption in pricing, reserving, and risk analysis
- More seamless workflow integration with core actuarial systems

Ethics, Regulation, and Governance

- Growing focus on ethical standards, transparency, and compliance
- Anticipate new guidance and regulatory frameworks

Continuous Learning & Collaboration

- Ongoing upskilling for actuaries in AI and data science
- Greater collaboration between actuaries, technologists, and regulators

Gen AI for Emerging Risks



Disruptive Technology & Cybersecurity

- Gen AI can scan and simulate potential AI-driven risks, identify system vulnerabilities, and generate mitigation strategies

Climate Change

- Quickly models multiple climate scenarios, helping actuaries stress-test portfolios and project long-term liabilities

Geopolitical Instability

- Simulates economic impacts of conflicts or trade disruptions, producing alternative risk scenarios for decision-makers

Financial Volatility

- Generates predictive simulations for market swings, interest rates, and inflation to support capital and asset-liability planning

Demographic Shifts

- Helps explore evolving mortality, morbidity, and long-term care trends, producing “what-if” population scenarios

Q&A



Thank You