The Actuary India

Magazine of the Institute of Actuaries of India

May 2025

Evolution OF Insurance Pricing

From GLMs to GBMs: The Evolution of Insurance Pricing in a Machine Learning Era

Breaking the stereotypes surrounding actuaries

The Actuary Stereotype: Crunching Numbers or Saving the Day?



Number Search Puzzle

Number Search

Humour

Humour Flashcards

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Editorial



Dear Readers,

As we move through the year, the May edition of our magazine brings together a thought provoking set of articles that reflect the evolving dimensions of actuarial work and identity.

We begin with Bani Dhar's engaging take in "The Actuary Stereotype: Crunching Numbers or Saving the Day?" – a reflection on how public perception and internal realities often diverge in our profession. The piece prompts us to consider not just what we do, but how we are seen and how we want to be seen – in a world that increasingly needs analytical leaders.

Trijot Singh takes us through a technical yet accessible exploration of modern pricing techniques in "From GLMs to GBMs". As actuaries become more deeply embedded in data-driven decision-making, this article highlights the journey from traditional models to cutting-edge machine learning approaches that are reshaping insurance pricing.

We also feature a comprehensive overview of the 16th Webinar on Data Science and Analytics, where Gourav Tyagi captures the energy and insight of the discussions on AI and its real-world applications in actuarial work. With digital transformation at the core of industry conversations, this webinar recap is a timely reminder of the importance of continuous learning.

We continue to cover the Global Conference of Actuaries (GCA) – the flagship event of the IAI. Our reportage section provides snapshots from various sessions and discussions, celebrating the diversity of thought, collaboration, and innovation that define the GCA. Whether you attended in person or virtually, we hope this coverage helps you relive the event's highlights or catch up on what you may have missed. Thank you for continuing to support The Actuarial Intellect (TAI). We encourage contributions from all corners of the profession – whether you're diving deep into technical nuances, voicing an opinion, or simply sharing a moment from your work or life that might resonate with your peers. The Culture section in particular offers a welcoming space for lighter reflections and creative expression, because there's more to being an actuary than just models and spreadsheets.

Warm regards,

Prakhar Mody
Editor, The Actuary India
Magazine of the Institute of Actuaries of India

May 2025

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Culture

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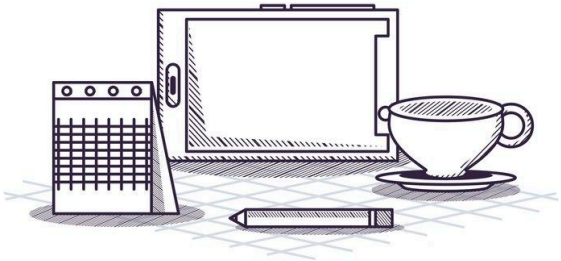
Culture

The Actuary Stereotype: Crunching Numbers or Saving the Day?



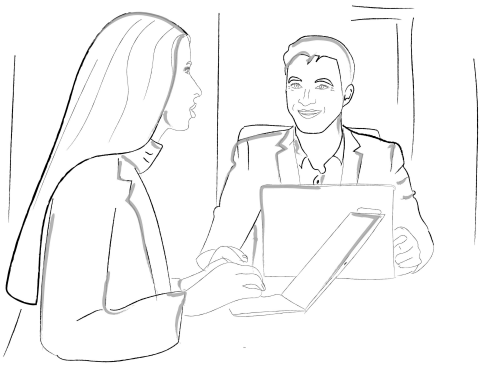
Picture this: It's 2003, my first year as an actuarial analyst at Genpact, and I'm at a family wedding in Delhi. The air is thick with the aroma of butter chicken, and my uncle, glass of lassi in hand, corners me. "So, Bani, you're an actuary? Like an accountant, right? Sitting in a dark room, crunching numbers all day?" I laugh, spilling a bit of my mango juice, and try to explain what I do. "Not quite, Uncle. Think of me as a fortune-teller with a calculator, helping people plan their future!" He blinks, clearly unconvinced, and I realize I'm up against *the stereotype*. You know the one: actuaries as bespectacled, spreadsheet-obsessed introverts who'd rather talk to Excel than humans. If you're a fresher reading this, you've probably heard it too. But let's set the record straight—actuaries aren't just number-crunchers. We're problem-solvers, storytellers, and, dare I say, superheroes in disguise.





That wedding moment stuck with me, not just for the comedic misunderstanding but because it revealed how little people know about our work. Back then, I was knee-deep in calculations, my desk a battlefield of coffee mugs and graph paper. I'll admit, the stereotype wasn't entirely wrong—I *loved* my spreadsheets. But my job was so much more. I was helping design plans that ensured participants could live with dignity. I was analyzing risks to keep companies financially sound. I was, in my own way, saving the day for clients who didn't even know my name.

Fast forward to 2008, when I was at Apollo Munich Health Insurance, leading a pricing project for a new health plan. One day, a colleague from marketing burst into our team room, waving a draft ad campaign. "Bani, we're calling actuaries 'the brain trust'—cool, right?" I chuckled, imagining my team as caped crusaders with calculators. But then I saw the ad mockup: a stock photo of a guy in a suit, staring at a computer, looking like he hadn't smiled since the invention of the abacus. "No way," I said. "We're not that dull!" So, I told them a story about our work—a single mom who got affordable coverage because of our pricing model. That story didn't just scrap the boring ad; it reminded me how our work touches lives.





The stereotype persists, though, and it's not just outsiders who buy into it. As a fresher, you might feel pigeonholed, like your exams and models define you. I get it. In my early days, I worried I'd become that caricature—chained to a desk, muttering about mortality tables. But then I started meeting clients, leading teams, and seeing the bigger picture. At Mercer, where I've spent over a decade, I've presented pension strategies to CEOs, mentored young actuaries, and even used AI to streamline analyses. Does that sound like "just crunching numbers"? I think not.



So, what's the truth about actuaries? We're architects of stability. In India, where financial security is a growing concern, we're the ones designing affordable insurance for gig workers, like the drivers on Ola, or pension plans for small businesses. Take my work in pensions: every calculation I make helps someone retire with peace of mind. That's not a number on a spreadsheet; that's a story of impact.



Humor me for a moment and imagine actuaries as superheroes. Our superpower? Turning uncertainty into clarity. Our kryptonite? Maybe the occasional bad coffee or a crashed Excel file (true story: I once lost a day's work to a rogue autosave). But our mission is clear: we protect people's futures. Whether it's pricing health insurance, forecasting risks for Pension Funds, or advising on annuity products, we're out there making a difference.



To my fellow freshers, don't let the stereotype dim your spark. You're not just studying for exams or building models—you're learning to solve real-world problems. Next time someone calls you a "number-cruncher," share a story. Maybe it's how your internship project helped a client, or how you explained a premium to a friend without jargon. I once told my cousin that actuaries are like chefs, blending data and creativity to cook up solutions. She still doesn't get it, but at least she stopped calling me an accountant!



I'd love to hear your stories, too. What's the funniest actuary stereotype you've encountered? Was it a friend who thought you predict lottery numbers, or a relative who asked if you "count money all day"? Share your tales in the magazine's forum or on our social media with #ActuaryNotAccountant. Let's rewrite the narrative together and show the world that actuaries are anything but boring. After all, we're not just crunching numbers—we're saving the day, one calculation at a time.

Narrated by



Bani Dhir

Director
Mercer

Bani Dhir is a Director at Mercer with 23 years of actuarial experience, specializing in health and pensions. When not debunking stereotypes, she's mentoring freshers or dreaming up new analogies to explain her work.

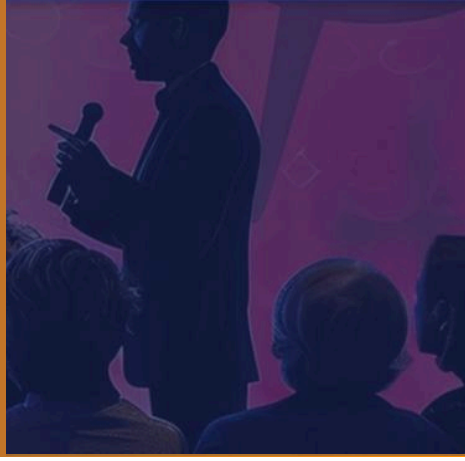
Resources

The Actuary India
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Pricing, Machine Learning

From GLMs to GBMs: The Evolution of Insurance Pricing in a Machine Learning Era

Join Trijot Singh as he breaks down how Generalized Linear Models (GLMs) changed the game back in the '90s, and how Gradient Boosting Machines (GBMs) are now taking things even further. Dive deep into an article which makes the future of insurance pricing feel accessible, exciting, and real.



Over the past few decades, insurance pricing has evolved dramatically, shaped by advancements in data availability, computational power, and modeling techniques. In the pre-digital era, insurers relied on underwriting expertise, rule-based systems, and rating manuals to determine premiums. While these methods were grounded in professional judgment, they often lacked the flexibility and granularity needed to respond to emerging risks and individualized customer data.

The 1990s marked a turning point with the rise of Generalized Linear Models (GLMs). Enabled by increased computing power and statistical software, GLMs allowed actuaries to model insurance risks more rigorously. They introduced transparency, separated frequency and severity modeling, and quantified the impact of individual risk variables — all while remaining compatible with regulatory frameworks. To this day, many firms rely on GLMs as a central part of their pricing methodologies .

However, the data landscape has changed significantly. The 2010s brought an explosion of new data sources — including telematics, IoT sensors, mobile apps, and online behavior tracking. GLMs struggled in the face of increasingly complex data, as their linear framework and limited interaction modeling couldn't keep pace — especially when variable selection became a tedious, iterative challenge.

This environment sparked the rise of the machine learning era in insurance pricing. Actuaries and data scientists began exploring more sophisticated modeling techniques that could adapt to the increasing complexity of risk. Among the most prominent tools in this space are:

- Gradient Boosting Machines (GBMs): Highly flexible and accurate, GBMs are particularly effective on structured tabular data. They excel at capturing non-linear patterns and variable interactions, and can be made interpretable using methods like SHAP values and Partial Dependence Plots (PDPs).
- Random Forests: Useful for quick benchmarking and understanding variable importance. While more robust to overfitting than GBMs, they typically offer lower predictive accuracy.
- Neural Networks: Best suited for unstructured data (e.g., telematics, text, images), neural networks can model highly complex relationships but require significant data volume and infrastructure.
- Elastic Net / Lasso Regression: Ideal for high-dimensional, sparse datasets. These models offer regularization, help with feature selection, and maintain a degree of interpretability

Among these, GBMs have emerged as a leading choice in modern actuarial pricing. They strike a practical balance between predictive performance and explainability — making them an increasingly attractive option for actuaries looking to augment traditional modeling with cutting-edge techniques.

Illustrative Practical Implementation

To demonstrate how modern techniques like GBM can enhance pricing accuracy, we turn to the California Housing dataset — a publicly available dataset commonly used for regression tasks. While it's not insurance data, it closely resembles the structure and setup of traditional GLM-based pricing models: clean, tabular data with several well-defined predictive features.

In this context, we can think of real-estate variables such as median income, location, and average number of rooms as analogues to insurance rating factors like driver age, vehicle type, or policy tenure. Our target variable, MedHouseVal(the median house value in the area, scaled in $100,000s), serves a similar purpose to a premium amount in insurance pricing.

By applying GBM to this structured dataset, we can illustrate how it captures complex nonlinear relationships and feature interactions that a GLM might overlook. This helps bridge the gap between traditional actuarial methods and machine learning approaches — showing how actuaries can evolve their pricing strategies using the same foundational data, but with more powerful modeling tools.

California Real Estate Data Structure:

Feature	Description
MedInc	Median income in the block group (proxy for affluence)
HouseAge	Median age of housing units (indicator of property age)
AveRooms	Average number of rooms per household
AveBedrms	Average number of bedrooms per household
Population	Total population of the block group
AveOccup	Average household occupancy (number of people per house)
Latitude	Geographic latitude (north-south position)
Longitude	Geographic longitude (east-west position)

Running GBM using python on Cal Real Estate data, and how to interpret the final output along with Factor Importance

Step 1: Preparing the Data We begin by loading and preparing the dataset — a process that will feel familiar to anyone used to working with GLMs. The data includes several structured predictors and a target variable, which in our case is a stand-in for the insurance premium.

Python code:

```
import pandas as pd
from sklearn.model_selection import train_test_split
from xgboost import XGBRegressor
from sklearn.metrics import mean_squared_error

 # Load sample dataset
df = pd.read_csv('cal_data.csv')  # Replace with your dataset
X = df.drop(columns=['premium'])
y = df['premium']

# Train-test split
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.2, random_state=42)
```

Step 2: Training the GBM Model Next, we use XGBoost, one of the most widely adopted GBM implementations, to train the model. Unlike GLMs, which require assumptions about linearity and variable distribution, GBMs learn directly from the data — capturing complex interactions without manual transformations.

Python code:

```
model = XGBRegressor(n_estimators=100, max_depth=3, learning_rate=0.1)
model.fit(X_train, y_train)

# Predict and evaluate
y_pred = model.predict(X_test)
print("RMSE:", mean_squared_error(y_test, y_pred, squared=False))
```

Step 3: Understanding Feature Importance One of the powerful features of GBMs is automated variable selection. Instead of manually iterating through stepwise regressions, we can visualize the influence of each variable directly.

Python code:

```
import matplotlib.pyplot as plt
from xgboost import plot_importance
plot_importance(model)
plt.title("Feature Importance")
plt.show()
```

This gives actuaries a quick, data-driven view of what's driving predictions - an efficiency leap over traditional GLM workflows.
Step 4: Making the Model Explainable with SHAP To bridge the gap between performance and interpretability, we use SHAP values. SHAP decomposes individual predictions into the contribution of each feature, turning GBMs into a transparent, auditable modeling tool.

Python code:

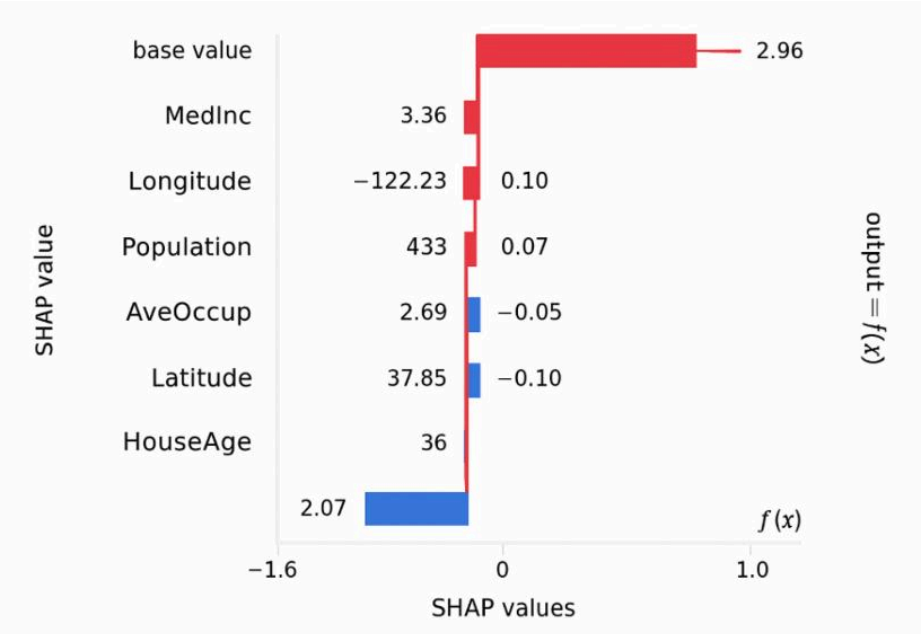
```
import shap
explainer = shap.Explainer(model)
shap_values = explainer(X_test)

# Visualize for a single prediction
shap.plots.waterfall(shap_values[0])   # Choose an index for policyholder

# Summary for overall feature impact
shap.plots.beeswarm(shap_values)
```

Interpreting SHAP Values: Visualizing the "Why" Behind Each Prediction

The SHAP plot below illustrates not just which variables influence the prediction, but also how they contribute to increasing or decreasing it — making even complex machine learning models like GBM fully interpretable for actuaries.



Each bar represents a feature's contribution to a single prediction.

- Red bars indicate a positive push on the predicted value (i.e., higher premium or price).
- Blue bars indicate a negative push (i.e., reducing the predicted value).

In this example:

- The base value (model's average prediction) starts at 2.96.
- Features like MedInc (3.36), Longitude, and Population push the prediction upward.
- Variables like AveOccup, Latitude, and HouseAge exert a downward influence.
- The net effect of all features shifts the prediction to a final value of 2.07.

Final Output:

Component	Value	Explanation
Base value	2.96	Average model output across all observations
Total positive SHAP impact	0.89	Combined effect of features increasing the prediction
Final prediction	2.07	Model output for this specific observation

Final Output Prediction

The model predicted a value of 2.96, meaning the estimated median house value is $296,000 for this observation.
This table breaks down the SHAP waterfall plot shown above. Each feature contributes to shifting the model's prediction from the base value (average prediction) to the final prediction for this specific case.

Feature	Value	SHAP Value	Effect
MedInc	3.36	↑	Strong positive impact – higher income raises the predicted house value
Longitude	-122.23	0.1	Slight positive effect – possibly due to proximity to coastal areas
Population	433	0.07	Small positive effect – suggests urban density may increase value
AveOccup	2.69	-0.05	Slightly negative – larger households may reduce per-unit home appeal
Latitude	37.85	-0.1	Negative – could reflect less desirable regions or higher
HouseAge	36	↓	Notable negative impact – older homes lower the predicted value

Several outputs from the GBM model using california dataset, not only demonstrate strong predictive power but also make intuitive sense

Scenario	Key Features	GBM Predicted Value (approx.)
High-income suburb	MedInc = 8.0, HouseAge = 10, Latitude = 34, Longitude = -118	$460,000
Urban area, moderate income	MedInc = 4.0, Population = 800, Latitude = 37, Longitude = -122	$320,000
Low income, high occupancy	MedInc = 2.5, AveOccup = 5.5, HouseAge = 45, Latitude = 36, Longitude =	$180,000
Coastal, high population, young homes	MedInc = 6.5, Population = 1200, HouseAge = 5, Longitude = -122.4, Latitude = 37	$500,000

GBMs don't just assess feature impact in isolation — they model how features work together to influence the outcome. This makes them ideal for pricing, where location, income, age, and density interact in complex ways.

Incorporating GBM into final pricing strategy

Once you've built and interpreted a Gradient Boosting Machine (GBM) model— especially using tools like SHAP to understand its inner workings—the next critical question becomes:
Should GBM be used on its own, or should it work alongside GLMs to strengthen them? Let's explore both options.
How do you incorporate GBM into your final pricing strategy?
Let's explore both options.
Option 1: Use GBM as a Standalone Pricing Model
In some cases, especially when predictive accuracy is the top priority, GBMs can replace traditional GLMs entirely.
Why use GBM alone?

- Captures complex nonlinearities and interactions
- Handles large volumes of structured data well
- Automatically learns which variables matter (no manual selection)
- Performs well with minimal tuning

When to use GBM standalone:

- When regulatory constraints are minimal
- When performance is significantly better than GLM (as shown by validation metrics)
- When you're using SHAP or LIME to meet explainability requirements

What you get:
A pricing model that is more accurate, especially in high-dimensional environments. SHAP plots allow you to defend pricing decisions even without a traditional regression framework.
Option 2: Use GBM to Enhance GLM – Turn Weakness into Strength
In regulated environments—or where interpretability and documentation are critical—GBMs can serve a supporting role rather than a replacement.
Here's how to do it:
1. Feature Selection Using GBM
Use GBM's built-in feature importance (gain, cover, or SHAP values) to:

- Identify which variables truly drive outcomes
- Eliminate redundant or irrelevant predictors
- Inform decisions about interaction terms and splines in GLM

2. Discover Interactions
Let GBM uncover nonlinear interactions (e.g., MedInc × AveOccup) and then:

- Explicitly model these in GLM using interaction terms or transformed variables

3. Feedback Loop
After incorporating GBM-driven insights into GLM, re-run diagnostics and compare:

- Performance (e.g., Gini, RMSE)
- Stability across segments
- Regulatory alignment and transparency

What you get:
A GLM that's:

- Simpler
- More focused
- Better aligned with real-world interactions

You're essentially using GBM as a discovery tool, while GLM remains the formal model for pricing and documentation.
Whether GBM becomes your main pricing engine or a tool to sharpen your GLM, it deserves a place in every modern pricing team's workflow.
By either:

- Deploying it directly with SHAP-based explanations, or
- Using its insights to restructure and validate your GLM, you can achieve the best of both worlds: accuracy and transparency.

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Conclusion

To conclude, the table below summarizes the key differences between Generalized Linear Models (GLMs) and Gradient Boosting Machines (GBMs) in the context of insurance / proxy real-estate pricing:

Aspect	GLM (Generalized Linear Model)	GBM (Gradient Boosting Machine)
Model Type	Linear / Parametric	Non-linear / Ensemble
Assumptions	Requires linear relationship between predictors and link function	Few assumptions — learns patterns from data
Feature Engineering	Heavy reliance on manual transformations and interactions	Automatically captures interactions and non-linearities
Interpretability	Highly interpretable (coefficients, p-values)	Less interpretable, but SHAP helps explain predictions
Regulatory Acceptance	Widely accepted in pricing filings (especially in insurance)	Less common in formal filings, but growing acceptance with explainability tools
Performance	Solid when assumptions hold	Generally better predictive accuracy, especially with complex data
Handling of Categorical Variables	Requires encoding (e.g., one-hot, manual bins)	Handles categorical features natively or via encoding
Speed	Fast to train and explain	Slower to train, faster to predict once trained
Use Cases	Base rate modeling, filings, auditing	Risk segmentation, fraud detection, marketing, pricing optimization

Whether you choose to replace or reinforce your GLMs, GBMs provide the flexibility and power needed to thrive in today's data-rich pricing environment.

About the author(s)

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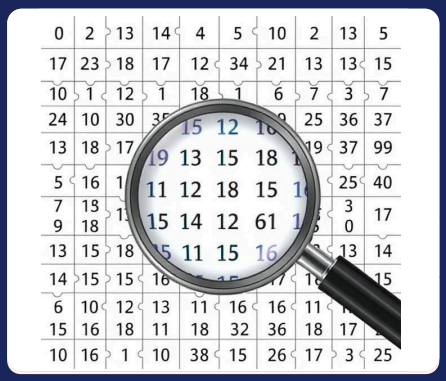


Trijot Singh

Actuarial Consultant
Strategic Pricing Advisor

Trijot brings over 14 years of global actuarial experience helping insurance companies unlock growth through smarter pricing. As a freelance consultant, he partners with insurers to design data-driven pricing strategies, strengthen regulatory filings, and modernize actuarial processes. His expertise spans commercial and health insurance, reinsurance pricing, rate adequacy monitoring, and advanced modeling techniques like GLMs and machine learning (GBM/XGBoost). With a strong focus on cross-functional collaboration, Trijot blends actuarial precision with business strategy—enabling underwriting, finance, and product teams to make informed decisions. He's also a developer of automation tools and Excel-based dashboards that streamline workflows and improve time-to-insight.

Puzzle



Number Search Puzzle

Number Search

Solve these crosswords by filling the correct number in each cell based on the clues provided. Take your time and as many attempts as you want (most importantly, don't give up). These are no more trickier than developing replicating portfolios! Enjoy this brain teaser by the Puzzle master: **Kathan Jain.**

9	5	6	5	7	4	9	6	2	4	0	7	1	3	7
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About the author(s)



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Kathan is a Fellow member of the IAI and the IFoA with a specialization in Pensions & Other Benefits and holds a B.Sc. in Actuarial Science from YCMOU. He's obsessed with food and enjoys binge-watching & solving puzzles in his free time.

Events

Events

Events: Webinar
16th Webinar On Data Science And Analytics

Reportage by

Gourav Tyagi



Speakers:

- Dr. Mayank Sharma
- Dr. Venkataraghavan Krishnaswamy
- Ms. Arunima Sinha - Moderator

Summary :

AI can revolutionize industries by driving efficiency and innovation, but it must be guided by ethical principles and robust governance.



Quotable Quotes

"Digital transformation is a journey, not a destination. It requires continuous adaption and innovation."



Quotable Quotes

"Harnessing data is like mining gold, the insights we extract drive our business forward."



Quotable Quotes

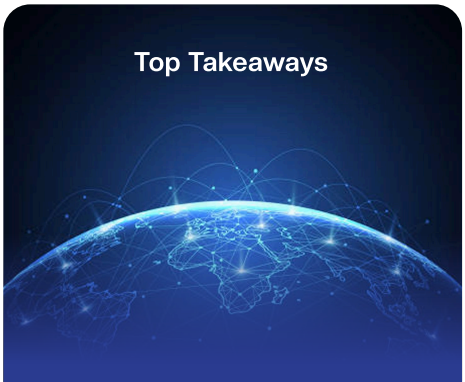
"Ethical AI is not just a choice, but a necessity to ensure trust and accountability in technology."



Quotable Quotes

"Cybersecurity is the backbone of digital transformation, protecting our data and ensuring safe innovation."





Digital transformation is crucial for staying competitive in today's fast-paced digital world.



AI and IoT are pivotal in driving innovation. These technologies are used in various industries to improve efficiency, enhance customer experience, and create new business models.



AI must be guided by ethical principles and robust governance to promote fairness and transparency.



Organisation needs to ensure data protection and privacy through compliance and governance frameworks.

Session notes

Webinar #16: Navigating Digital Transformation: AI in Action Date: 01-Mar-2025

Speakers of the session who have chosen a different path in their respective careers

- Dr. Mayank Sharma serves as an Associate Professor in the Information Technology and Systems area at the IIM, Kashipur. He earned his doctorate from the IIM, Lucknow. He teaches courses such as Management Information Systems, Social Media Analytics, and AI & Deep Learning.
- Dr. Venkataraghavan Krishnaswamy holds a PhD in Information Systems from the IIT, Madras. He has an industry experience of eight years and trains industry participants on the application of ML techniques using open-source technologies.
- Ms. Arunima Sinha, Chair of DS&AI in the IAI. She is a Qualified Actuary and currently the Assistant VP leading Chubb's North America Insurance Analytics.

Digital Transformation by Dr Mayank Sharma

Definition: Digital transformation involves leveraging digital technologies to create value for stakeholders.

Key Technologies: AI, IoT, Cloud Computing, Machine Learning, Blockchain, Augmented Reality, and Virtual Reality.

Process:

- **First Order Capabilities: Informational Capabilities:** These are the basic capabilities derived from digital technologies that provide information. For example, the internet provides scalability, openness, and 24/7 availability, allowing organizations to gather and disseminate information.
  Examples: Gathering customer data, tracking supplier information, and monitoring product status.

- **Second Order Capabilities: Decision-Making Capabilities:** These capabilities enable organizations to make informed decisions based on the information gathered. This includes quick decision-making, historical analysis, predictive analytics, and automated decision execution.
  Examples: Identifying high-value customers, predicting market trends, and automating supply chain decisions.

- **Higher Order Capabilities: Business Capabilities:** These are advanced capabilities that align with the organization's strategy and create value. They include improving time-to-market, enhancing process efficiency, gaining competitive advantage, and achieving key performance indicators (KPIs).
  Examples: Retaining customers, improving customer satisfaction, optimizing supply chain management, and innovating new products and services.

Key Summary: IoT connects devices and systems, enabling real-time data collection. AI extracts the insights from the collected data that drives the business value. So, the intersection of AI and IoT is where the magic happens.

Case Studies:

- Exide Industries: Improved battery manufacturing process in real time through the deployment of IoT sensors.
- Save Mom: Personalized prenatal care to women, reduced maternal and infant mortality using IoT and AI.

AI and Its Application by Venkataraghavan K

Definition: AI involves designing intelligent agents that receive percepts from the environment and take actions.

Branches of AI:

- **Robotics:** Creation of objects that can move around autonomously, such as robotic vacuum cleaners and autonomous vehicles.
- **Computer Vision:** Enables machines to perceive and interpret visual information from the environment, used in applications like self-driving cars and facial recognition.

- **Automated Reasoning:** Development of systems that can create algorithms to solve problems autonomously.
- **Natural Language Processing (NLP):** Allows machines to understand and interact with human language, used in virtual assistants like Siri and Alexa.
- **Machine Learning:** The branch that provides tools and techniques to make machines intelligent by learning from past examples.

Case Studies:

- **Ping An:** "Good Doctor" AI-based healthcare platform for diagnosis and treatment recommendations. Values at $7.5billion in 2018.
- **Stitch Fix:** AI-driven personal fashion recommendation engine. Enhanced customer experience, increased sales and reduced inventory waste.
- **CCC Intelligent Solutions:** AI-powered auto claims processing for the insurance industry. Reduced claim processing time from weeks to minutes and improved accuracy in claim settlements, reducing disputes.

Ethical Considerations and Cybersecurity

Ethical AI:

Responsible AI:

- Important to ensure that AI systems are designed and used in a way that is ethical and responsible. This includes considering the impact of AI on society and ensuring it is used for the greater good.
- Ensuring that AI models are transparent and interpretable to ensure trust requires implementing frameworks & policies to govern the AI models' development.

Cybersecurity:

Data Protection and Compliance:

- Implementing measures to protect data from breaches and unauthorized access. This includes using encryption, access controls, and secure data storage.Adhering to regulations and standards to ensure data privacy and security.
- Identifying and mitigating risks associated with the use of digital technologies.

Key Summary: AI has the potential to revolutionize industries, but it must be guided by ethical principles and robust governance.

About the author(s)



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Gourav is a Fellow of the Institute of Actuaries of India with experience in Life Modelling, Experience Study and Advanced analytics. He is passionate about maintaining both physical and mental fitness through practicing 'Wing Chun' and traveling to ancient temples.

Events



Events: 24th GCA
Session #7: Embracing Disruption with Dynamic models

Reportage by

Vidhi Gogri



Speakers:

- Mr. Abhay Tewari
- Mr. Erik Bleekrode
- Ms. Ashna Satyajit

Summary :

This session introduced three game-changing innovations—Kalman Filters, Recurrent Neural Networks, and the Sparse Grid Method that will transform actuarial practices by enhancing accuracy, efficiency, and adaptability in modeling and risk management.

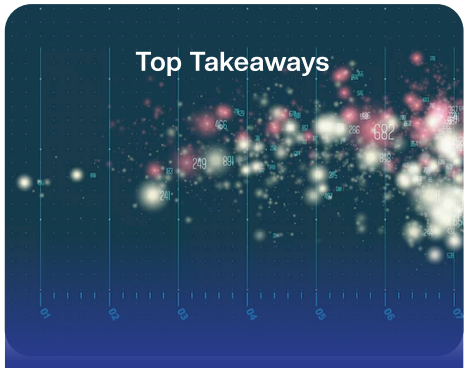




Adaptability is crucial for modern actuarial practices.



Leveraging diverse data sources enhances accuracy.



Efficient modeling methods like the Sparse Grid Method reduce computational burden.

Session notes

Session #7: Embracing Disruption with Dynamic models Date: 18-Mar-2025

Speakers of the session who have chosen a different path in their respective careers

- Mr. Abhay Tewari is the Managing Director and CEO of Star Union Dai-ichi Life Insurance, with extensive experience in actuarial and financial services.
- Mr. Erik Bleekrode is the Head of Insurance for KPMG in the Asia-Pacific region, based in Hong Kong, with extensive experience in the financial services industry.
- Ashna is a young actuary specializing in life domain, actively assisting life insurance companies in India with IFRS 17-related matters.

The Three game-changing innovations to enhance actuarial practices.

1. **Kalman Filters:** State space models that filter out noise and blend observed values with prior estimates.
- Refine mortality estimates in real-time.
- Incorporate diverse data sources (age, gender, financial status, etc.).
- Handle non-linear shifts and cohort effects.
- Utilize incomplete data from low insurance penetration areas.
- More accurate, adaptive, and comprehensive mortality assumptions.
- E.g. In GPS navigation, Kalman filters adjust routes based on new data points, recognizing smaller roads not initially accounted for.

2. **Recurrent Neural Networks (RNNs):** Machine learning models that use past information to predict future outcomes.
- Dynamic lapse assumptions based on a wide range of policyholder data.
- Short-term and long-term predictions of policyholder behavior.
- Granular insights from unstructured and sensory data.
- Proactive risk management by detecting emerging risks.
- Adaptive models that evolve with policyholder behavior, leveraging all available data for accurate predictions.

3. **Sparse Grid Method:** Reduces computational intensity in stochastic modeling by evaluating fewer grid points.
- Smolyak Algorithm: Controls grid points based on refinement level.
- Hierarchical Basis Function: Selects grid points for accuracy.
- Adaptive Error Estimation: Adds grid points in high-error regions.
- Efficient, accurate, and scalable stochastic modeling.
- E.g. A study showed that the Sparse Grid Method required only 4,000 simulations to achieve low error, compared to 1 million simulations needed by Monte Carlo.

Conclusions and Final remarks

The session highlighted three transformative innovations for actuarial practices:

- **Kalman Filters:** These advanced statistical models help refine mortality estimates by filtering out noise and incorporating diverse data sources, leading to more accurate and adaptive assumptions.
- **Recurrent Neural Networks (RNNs):** By leveraging machine learning, RNNs provide dynamic lapse assumptions, utilizing a wide range of policyholder data to predict behavior more accurately and proactively manage risks.
- **Sparse Grid Method:** This method enhances stochastic modeling by reducing computational intensity while maintaining accuracy, enabling more efficient and scalable analyses.

Together, these innovations will drive a shift towards a more data-driven, adaptive, and resilient actuarial practice, ultimately contributing to a more inclusive insurance industry by 2047.

About the author(s)



Vidhi Gogri

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Vidhi is an aspiring actuary with over two years of experience in the non-life insurance sector. She has expertise in IFRS 17, reserving, and stress testing. In her free time, she loves playing sports and enjoys listening to music.

Events



Events: 24th GCA
Session #1: Actuarial Judgment

Reportage by

Nishant Mittal



Speakers:

- Mr. Scott Holmes
- Dr. Frank Chang
- Mr. Brian Chiarella

Summary :

The session explores the meaning, development, and application of actuarial judgment, emphasizing its importance in the actuarial profession alongside codes of conduct and professional standards.



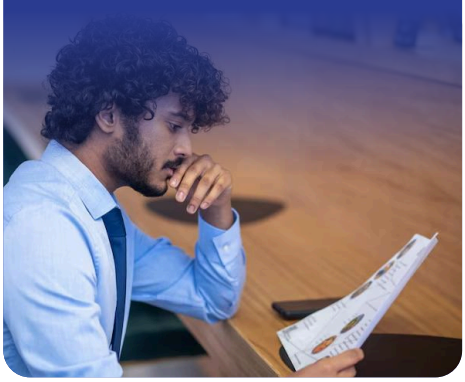
Quotable Quotes

"Stay grounded in professional standards and codes of conduct."



Quotable Quotes

"Stay objective and use critical thinking skills to analyze the reasons behind the pressure."



Quotable Quotes

"Make ethical decisions and maintain healthy professional boundaries."



Quotable Quotes

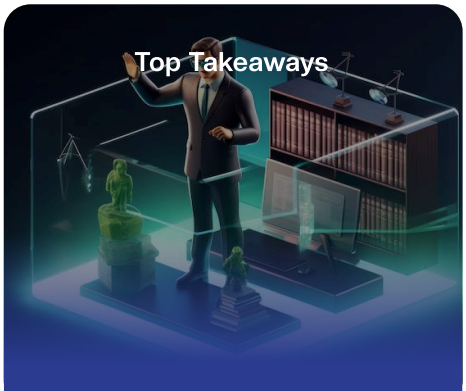
"Seek advice if you're unsure how to handle a challenging situation."



Quotable Quotes

"Keep detailed documentation of all critical decisions and the reasons behind them."





Top Takeaways

Actuarial judgment is a critical skill that goes beyond technical expertise, incorporating ethical considerations and professional standards that include integrity, competence, compliance, impartiality and communication.



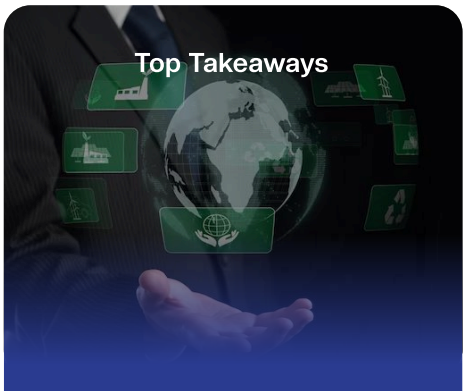
Top Takeaways

Actuarial judgment is essential in various situations, such as data selection, methodology choice, assumption setting, result interpretation and requires education, qualification, practical experience and a strong understanding of the business context.



Top Takeaways

Practical experience involves knowing your data, reviewing diagnostics, understanding the strengths and weaknesses of methods, performing sensitivity tests and checking your work.



Top Takeaways

A comprehensive understanding of the business includes factors like data quality, risk classification, trends, expenses, credibility and the economic environment.

Session notes

Session #1: Actuarial Judgment

Date: 18-Mar-2025

Speakers of the session:

- Mr. Scott Holmes is a Sales Director at Quantee, UK.
- Dr. Frank Chang is a Vice President of Applied Science at Uber, US.
- Mr. Brian Chiarella is a VP & Principal at Lewis & Ellis, India.

Highlights of the Session:

- The session focuses on the concept of actuarial judgment, explaining its significance within the actuarial profession, and how it is applied in practice.

- **Introduction to Actuarial Judgment:** The session begins by defining "judgment" and then distinguishing between expert and professional judgment

Expert vs. Professional Judgment:
- Expert judgment is based on training, knowledge, experience, and expertise.
- Professional judgment incorporates these elements but is further guided by a code of conduct.

Codes of Conduct and Professional Standards: The session emphasizes that professional judgment is exercised within the framework of various codes of conduct and professional standards established by organizations like the Institute of Actuaries of India (IAI), the International Actuarial Association (IAA), and others.

Common Duties of an Actuary: The core responsibilities of an actuary include:
- Integrity
- Competence and care
- Compliance
- Impartiality
- Communication

When Actuarial Judgment Is Used: Actuarial judgment is applied in numerous situations, including:
- Choosing data
- Dealing with missing or inappropriate data
- Selecting methodologies and models
- Setting assumptions
- Testing reasonableness of model outcomes
- Interpreting results
- Selecting from multiple methods
- Dealing with constraints

Developing Actuarial Judgment: The development of actuarial judgment involves:
- Education
- Qualification
- Practical experience
- Understanding of the business

Practical Experience: The session emphasizes the importance of practical experience in honing actuarial judgment. This involves:
- Understanding data
- Reviewing diagnostics
- Knowing the strengths and weaknesses of methods
- Performing sensitivity tests
- Checking work

Understanding the Business: A key aspect of actuarial judgment is having a strong understanding of the business context, including:

- Data organization and quality
- Exposure base
- Risk classification
- Premium and loss adjustments
- Trends
- Expenses
- Credibility
- Reinsurance
- Infrequent events
- Product configuration and coverage features
- Claims handling
- Distribution channels
- Operational changes
- Economic environment
- Internal considerations

Indications of Good Actuarial Judgment: The session outlines several indicators of sound actuarial judgment:

- Consistent decision-making
- Confidence from others
- Ability to anticipate outcomes
- Critical thinking skills
- Ability to learn from mistakes
- Ethical decision-making
- Flexibility
- Peer review

Maintaining Good Actuarial Judgment Under Pressure: The session provides guidance on maintaining sound judgment in challenging situations:

- Adhering to professional standards
- Transparent communication
- Objectivity and critical thinking
- Ethical decision-making
- Seeking advice when unsure
- Detailed documentation

Conclusions and Final remarks

- The session underscores that actuarial judgment is a cornerstone of the actuarial profession.
- It is not simply the application of technical skills, but a nuanced blend of knowledge, experience, ethical considerations, and adherence to professional standards.
- Actuarial judgment is essential for navigating complex situations, making sound decisions in the face of uncertainty, and ultimately upholding the integrity and reliability of actuarial work.

About the author(s)



Nishant Mittal

Actuarial Analyst
Student Member of Institute of Actuaries of India

Nishant is an Actuarial student currently pursuing Masters in Actuarial Science from University of Mumbai along with practical knowledge of process automation and actuarial modelling. Out of office, he enjoys playing Chess and exploring new places and topics.

Events

Events: 24th GCA
Session #3 - Impact of AI And Technology in General Insurance

Reportage by

Nishant Mittal



Speakers:

- Mr. Hiten Kothari
- Mr. Mohit Garodia
- Ms. Deshna Jain

Summary :

The session explores how AI and technology are revolutionizing general insurance by enhancing efficiency, accuracy, and decision-making across various functions, from reserving and claims to pricing and portfolio analysis.



Top Takeaways



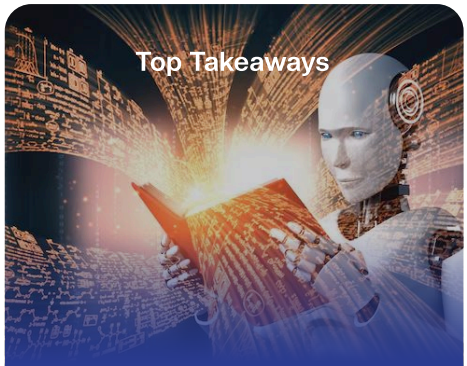
AI and technology are transforming General Insurance (GI) across various functions where traditional manual processes in GI are being replaced by more efficient, automated solutions.

Top Takeaways



AI improves accuracy in areas like claim assessment, reserving and enables better fraud detection and prevention.

Top Takeaways

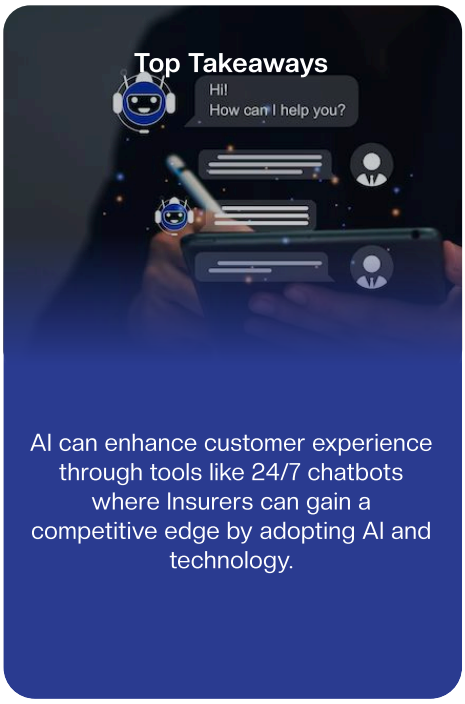


Machine learning models can capture complex data relationships that traditional models cannot.

Top Takeaways



Automation reduces human bias and errors in processes like claim handling and data cleansing which is crucial for accurate and reliable results in underwriting, pricing, reserving, and capital modelling.



Session notes

Session #3 - Impact of AI and Technology in General Insurance

Date: 18-Mar-2025

Speakers of the session:

- Mr. Hiten Kothari is a Senior P&C Director in Insurance Consulting & Technology at Willis Towers Watson, India.
- Mr. Mohit Garodia is a Senior Actuarial Analyst at Willis Towers Watson, India.
- Ms. Deshna Jain is a Senior Actuarial Analyst at Willis Towers Watson, India.

Key Areas of Impact

The impact of AI and technology in the following key areas of General Insurance:

Reserving:

- Initial estimation of case reserves can be more accurate with technology that predicts the amount to be paid to the insured by using accurate pictures of the incident.
- Identifying trends like changes in case reserving philosophy, inflation, and rate changes can be automated.
- Optimized segmentation using AI can analyse historical claims, policyholder behaviour, and external data to create precise risk segments.
- Machine learning algorithms can identify patterns in claims development.
- A case study is presented on how AI can be used to decide if claims should be reserved at a motor TP segment level or separately for property damage and death and injury claims.

Machine Led Reserving (MLR):

- The algorithm is objective, scalable, and transparent.
- MLR can help in producing best estimate reserves and can help appointed actuaries to understand differences between carried reserves MLR and best estimate reserves.
- MLR can help understand the strengthening and worsening of reserves as compared to best estimated reserves.

Claim Handling and Settlement:

- Automation of claim assessment reduces human bias and manual errors and speeds up settlements.
- Automatic communication of claim discrepancies to claimants.
- Enhancement of claim accuracy using AI to assess photos and determine payable amounts.
- Reduction in the need for claim handlers, thus cutting claim handling expenses.
- Detection of fraud trends and analysis of fraud-prone demographics.
- Improvement in customer experience with 24/7 AI-powered chatbots.

Data Cleansing:

- Detection of data anomalies, inconsistencies, and missing data.
- Identification of duplicate customer records and generation of audit trails.
- Ensuring data accuracy for underwriting, pricing, reserving, and capital modelling.
- Automation of mundane data processing, leading to reduced processing time and more time for data analysis.

Pricing Innovations:

- **GBMs and Other Modelling Algorithms:** Machine learning models capture complex relationships in the data, handle multiple data types, and analyse feature importance. However, they can be complex and may overfit small datasets.
- **Auto-GLMs:** Initial variable ranking and two-way interactions using boosting models. Binning of categorical variables, custom grouping, and simplifications.
- **Clustering:** Segmentation of customers based on risk profiles for more accurate premium pricing and improved profitability.

Other Domains:

- **Portfolio Analysis Innovations:** Identifying profitable segments using clustering algorithms and portfolio optimization using AI models.
- **Claims Analytics Innovations:** Image and video analysis for automating damage assessment, and fraud detection using machine learning algorithms.

Conclusions and Final remarks

- AI and technology are crucial in modernizing general insurance operations. They offer enhanced efficiency, accuracy, and decision-making capabilities.
- By automating processes, improving data quality, and providing deeper insights, AI and technology enable insurers to reduce costs, mitigate risks, and improve customer satisfaction.

About the author(s)



Nishant Mittal

Actuarial Analyst
Student Member of Institute of Actuaries of India

Nishant is an Actuarial student currently pursuing Masters in Actuarial Science from University of Mumbai along with practical knowledge of process automation and actuarial modelling. Out of office, he enjoys playing Chess and exploring new places and topics.

Events

Events: 24th GCA
Session #19: Climate Risk And The Role Of Actuaries

Reportage by

Pavitra Gujrati



Speakers:

- Ms. Asha Murali
- Ms. Prerna M Sadarangani

Summary :

The session highlighted the growing importance of climate risk and emphasized the evolving role of actuaries in assessing, modeling, and managing these risks to support sustainable financial decision-making.



Quotable Quotes

"Disclosures such as those recommended by the TCFD will play a vital role in climate-aware financial systems."



Quotable Quotes

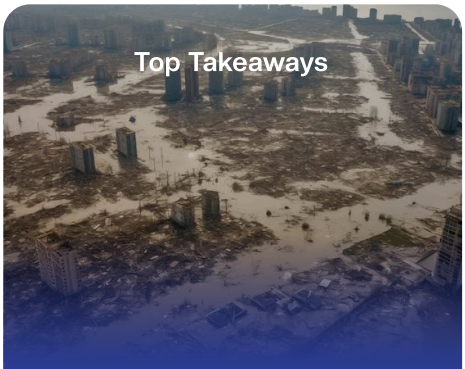
"Financial risks from climate change are relevant to all actuaries, regardless of their practice area."



Quotable Quotes

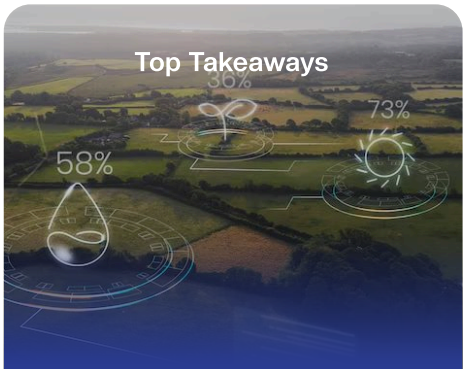
"Scenario analysis is a key tool in the actuarial response to climate risk."





Top Takeaways

Climate change impact is real, evidenced by extreme weather events.



Top Takeaways

Actuaries can play a vital role in climate risk management:

- Consider Physical, transitional, and liability risk.
- Improve view of risk expected. Climate risk identification frameworks.



Top Takeaways

Challenges are expected, but also workarounds.

- Resolving data gaps.
- Acknowledge assumptions and limitations clearly

Session notes

Session #19: Climate risk and the role of Actuaries Date: 19-Mar-2025

Need for the study of Climate change

- Actuaries are uniquely positioned to quantify long-term risks and model uncertain future scenarios. Studying climate change equips them to incorporate climate risk into pricing, reserving, and capital modeling.
- Climate change poses significant threats to ecosystems, human health, infrastructure, and economies. It leads to extreme weather events, rising sea levels, and shifting climatic patterns.
- The economic losses due to climate-related disasters are escalating. Insurers and actuaries need to understand these trends to price risk accurately and manage portfolios effectively.
- Understanding climate risks is essential for long-term strategic planning, especially for sectors like insurance, finance, and retail.

Challenges - Faced and Embraced in the study of Climate change.

- Climate models involve high uncertainty, making it tough to predict risks with accuracy. This complicates long-term planning and decision-making.
- There is a lack of detailed and reliable historical data for rare but severe climate events, limiting the quality of risk assessment.
- Translating broad global climate projections into specific local impacts remains a major challenge for actuaries.
- Climate change operates on long-term horizons, which don't align well with traditional actuarial models based on short-term trends.
- Regulatory requirements for climate risk disclosures are still developing, leading to uncertainty in compliance and reporting.
- Effective climate risk analysis requires collaboration with experts from climate science, economics, and environmental policy.
- Existing actuarial tools and techniques need to evolve to incorporate scenario analysis and climate stress testing.
- Actuaries face growing pressure from regulators, investors, and the public to address climate risks transparently and sustainably.

Conclusions and Final Remarks

- Climate change is a critical and immediate issue that actuaries can no longer overlook.
- The profession must evolve beyond traditional methods to address long-term and uncertain climate risks.
- Interdisciplinary collaboration is essential to develop accurate and holistic climate risk models.
- Despite challenges like data limitations and model uncertainty, actuaries have the tools to lead in this space.
- Embracing climate-focused practices enhances both risk preparedness and long-term sustainability.
- Actuaries have a unique opportunity to drive positive change and contribute to a more resilient future.

About the author(s)



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Pursuing Data Science from IIT Guwahati

Pavitra is a dedicated actuarial professional with internship experience in the life Insurance and employee benefits domain. With a strong fundamental in Data Science and actuarial concepts, Pavitra brings analytical rigor and a keen interest in risk assessment, modelling and data-driven decision-making in insurance sector. Outside of work, he is an avid chess player and enjoys travelling and watching movies.

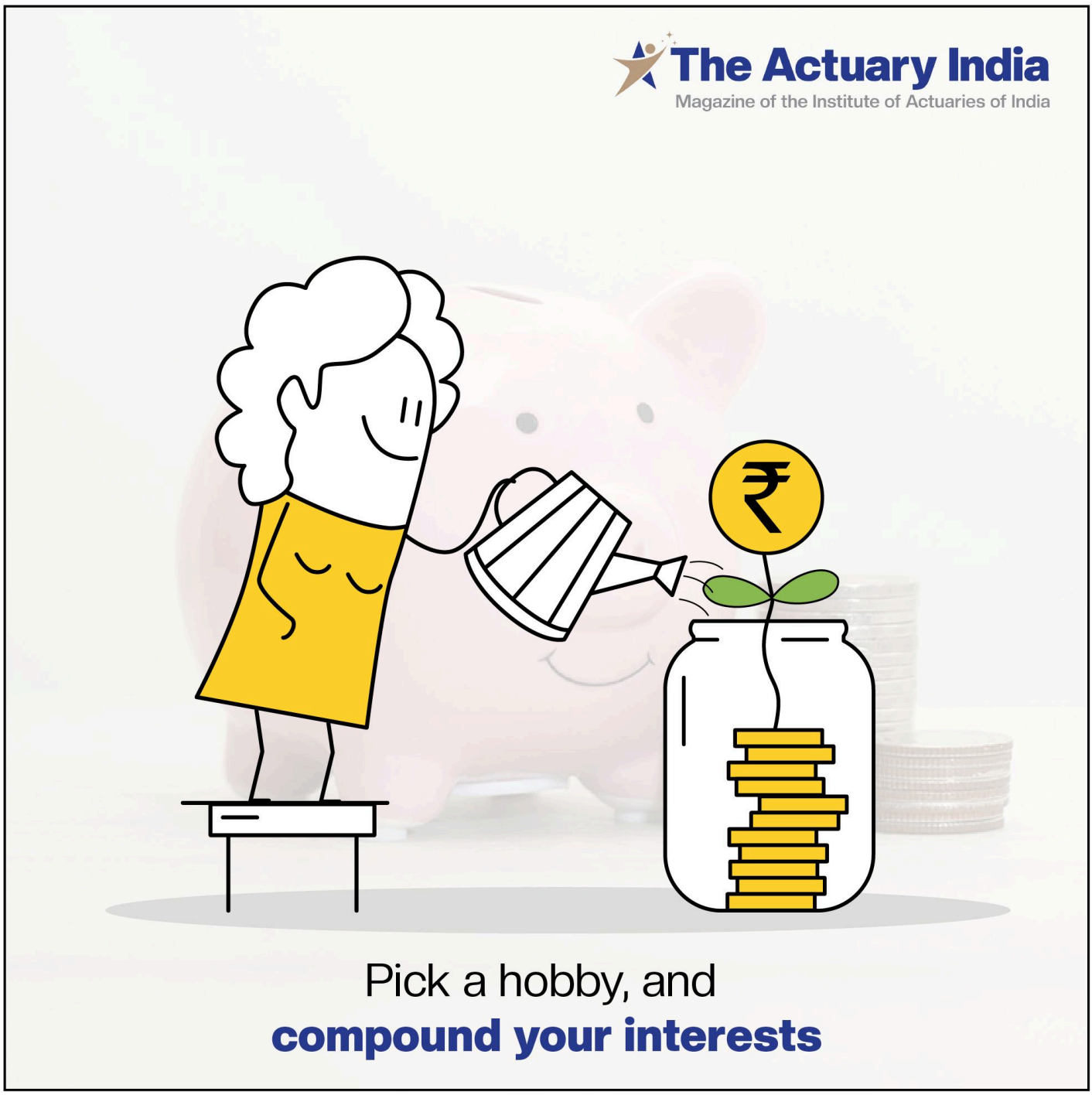
Humour

Humour

An actuary walks into Ā

A light-hearted take on the hopes, aspirations, trials, tribulations and perhaps even foibles of everyday actuaries in their everyday lives.



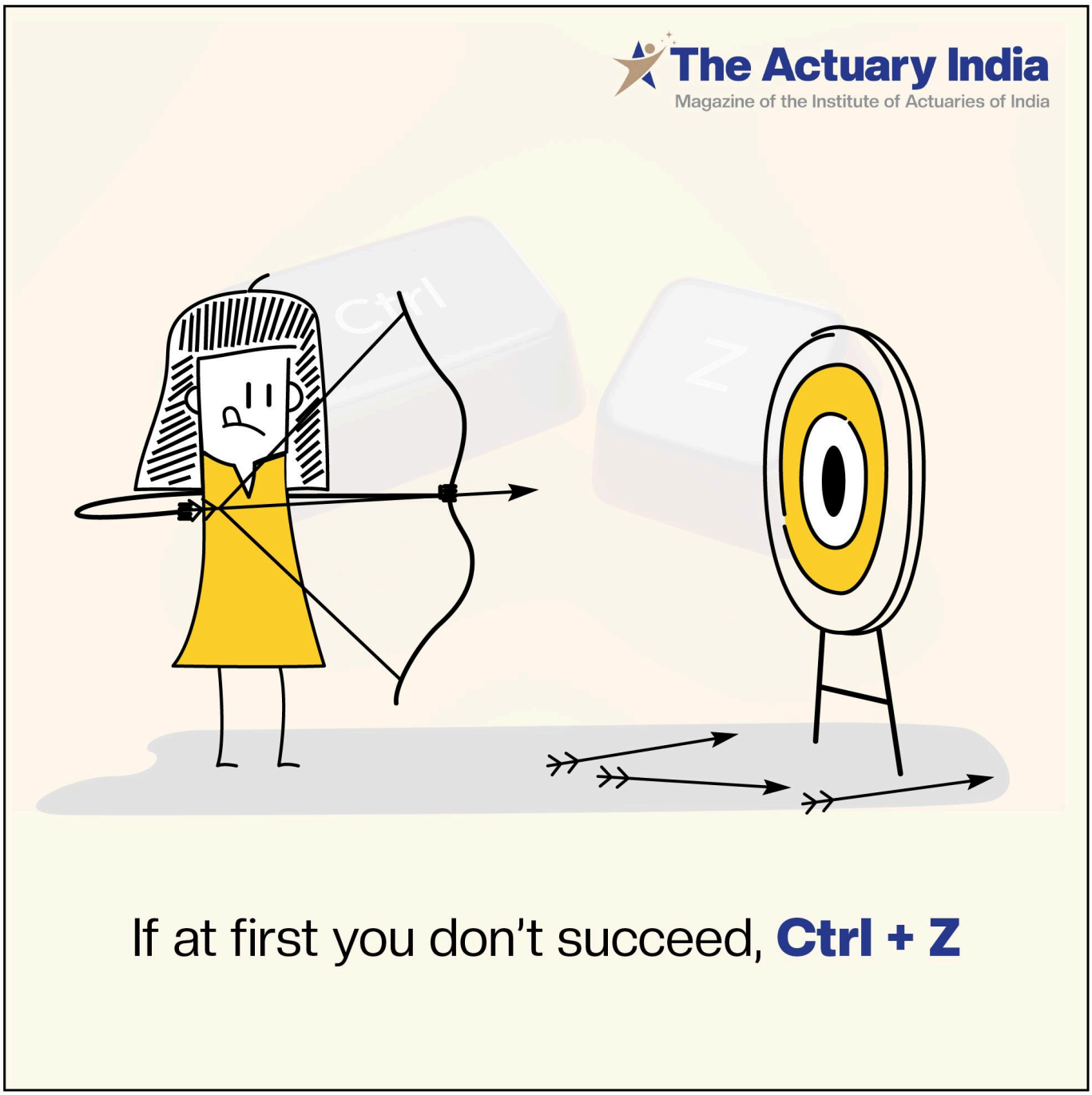


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A light-hearted take on the hopes, aspirations, trials, tribulations and perhaps even foibles of everyday actuaries in their everyday lives.





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Chief editor

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She volunteers actively for the profession and is a classical dancer who enjoys swimming, blogging and reading.



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The Institute of Actuaries of India (IAI) is a statutory body established under The Actuaries Act 2006 (35 of 2006) for regulating the profession of Actuaries in India. The provisions of the said Act have come into force from the 10th day of November 2006, in terms of the notification dated 8th November 2006, issued by the Government of India in the Ministry of Finance, Department of Economic Affairs.

The Actuary India is the flagship magazine of the IAI that has been in publication for over two decades. We aim to provide our members and the larger actuarial community a platform to connect, exchange views and promote thought-leadership and research beneficial to the profession.

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