PRESENTATION

Causal knowledge graphs for risk interpretation using LMM: A new tool for insurers

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Dylogy



1. Context & Approach

Several factors limit a proper understanding of risks

- + The organisation of knowledge
- + Its use in actuarial tools
- + Its interoperability between teams



The use of Gen Al allows for better

+ Data: multimodal processing of document corpora
+ Preparation: standardised, typed, scalable data model
+ Processes: sequenced LLMs to structure in DAGs



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Multi-dimensionality



Visualisation

P-1	Premium Amount \$30.13M		No Of Claim By Channel Phone 212 Agent 189	Claim Amount Comparison Over Time Year • 2021 • 2022 • 2023			
Claim Overview	Claim Amount \$15.07M	No Of Claim	Online 411	51.1M 50.6M 50.6M 50.7M 50.7M 50.7M 50.7M 50.7M 50.7M 50.7M 50.7M			
Loss Ratio	New 154	Pending 316	Claim Trend By LOB	Loss Ratio by Product			
	Paid 187	Denied 203	and the second s	Life Health Morrie Corporate Auto			
Q Manager Overview	Submitted 37.27K	Hit Ratio 80%	New Policy by Last 12Months	Avg Customer Satisfaction Rating			
	Written 29.88K	Declined 7395	4.5° 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8				
Agent Profile	Renewed 65.90%		Policy by Status Pending 27.37% Active 36.82%	Premium by Policy Type			
	Reviewed 47.89%	Policy Premium	Expired 35.81%	Health Commercial Life			

Aggregation



Correlation & chronology



Inalterability











2. Results

Time

+ 1min / ref

Cost

+ 1 to 5€ / ref

Graphs

+ 1-5 graphs / ref + Metadata graphs twins + 30 to 90 event type + Attribute distributions



Evaluation

+ Few errors

+ 30 attributes on average

+ Aggregation by ref limited to

2 or 3 given the size of the chunks

+ 4-10 node per graph



Figure: Example of attribute distribution





Figure: Example of parallel chart to represent co distribution of events

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Figure: Example of aggregated graph



3.Usages

Consultation & visualisations

+ App for organizing ref and making graphs readable

Claims Library	Claim Summary		<			Changes Legend
Q Search claims ▼ All	Claim Amount	Duration 45 days Avg: 35 days	* ~	 > Storm Damage Storm O May 4, 2021 Severe thunderstorm with wind gusts up to 64 MPH 		 New elements Modified elements Primary cause Direct consequence
Power Plant Generator Failure In Progress PER20WPO0222 Critical failure in main generator unit leading to	Date of Loss	Location Unknown 3 similar in region	0	HAS_GAUSE		 Indirect consequence Mitigation actions Resolution
complete shutdown of power generation 1 2024-02-15 \$ \$2.5M Energy High Severity	Policy Number POL-2024- 789-456	Status In Progress 80% resolved	<u>.</u>	• O May 4, 2021 Storm caused transmission lines to fall and damage	e <mark>ttAb_CAUGE</mark>	
Cargo Ship Collision Closed	5 active policies			HAS_GAUSE		
Container vessel collision in port resulting in significant hull damage and cargo loss 2023-11-30 \$ \$2.3M Marine Medium Severity	Broker Global Risk Partners 15 claims handled	Adjuster Smith & Associates 8 claims managed	°C	 > Wind Turbine Shutd Business Interruption ③ May 4, 2021 63 wind turbines on the north side of the property were 	 Road Damage Property Damage May 4, 2021 Rainfall during the storm caused damage to acces 	
Product Liability Case Closed	\mathcal{O} Similar Claims	Sho	w All 🗸		OLLOWED (+1 days)	
PER19WPO0212 Multiple claims filed regarding product defect in consumer electronics. Quality control process 1 2023-12-15 \$ \$1.8M	PER19WP0019885% SimilarEquipment failure leading to business interruption\$ \$2.3M (b) 45 days			 Repair and Restorati Repair May 4, 2021 Repair and replacement of damaged transmission lines, 		
PI Medium Severity	PER18WPO0156 Similar incident at manufactu	72% Si ring facility	milar			

Figure: App to get access to claims graphs

Requests & agents

+ Natural language query to Cypher query to LLM

Incident Reports Chatbot

• Chat with our agent to easily explore incident reports stored in a graph database.

Ę	Chatbo

What types of incidents are most frequently reported?

Based on the data analysis, there are two main types of incidents that are reported with equal frequency:

1. Explosion incidents - These represent one type of reported incident

2. Pressure Rupture incidents - These also represent one type of reported incident

. . .

Both types of incidents appear to occur with the same frequency in the dataset, with each type accounting for one reported case. This suggests that explosion events and pressure rupture events are equally common among the incidents that have been documented.

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Figure: Example of agentic system to dive into aggregated graph

References

+ Creation and updating of classes based on free attributes

```
"node__properties__eventCategory": {
    "Abnormal or Unplanned": "Abnormal or Unplanned",
    "Anchor Drag": "Anchor Drag",
    "Assessment": "Assessment",
    "Assignment": "Assignment",
    "Authorization": "Authorization",
    "Blowout; no fire": "Blowout; no fire",
    "Bodily Injury": "Bodily Injury",
    "Burglary": "Bush Fire",
```



4. Business applications

Pricing

+ Estimate average cost/occurrence using Markov techniques + If NA, set up a clustering system

Reserving



+ Suggest other segmentations + Identify developments losses + Assess impacts of changes in DAG + Identify causes leading to no costs

Prevention

+ Observe common root causes, deduce preventive actions + Identify secondary causes or consequences to limit transmission + Suggest methods to minimise costs

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Thank you for your attention





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