



WHITEPAPER

LEVERAGING GEOCODING TECHNOLOGY FOR PRECISION RISK ASSESSMENT IN THE INSURANCE INDUSTRY

Executive Summary

Accurate location data is foundational to modern insurance risk assessment. Geocoding—the process of converting addresses into precise geographic coordinates—has emerged as a critical technology enabling insurers to analyse and price risk at increasingly granular levels. However, not all geocoding solutions deliver equal accuracy, with significant variations across countries, property types, and service providers.

This whitepaper examines how the insurance industry can leverage advanced geocoding solutions to enhance operational performance, improve risk assessment accuracy, and drive competitive advantage. Our comprehensive evaluation of leading geocoding services across seven countries reveals dramatic differences in accuracy, with error rates ranging from 0% to 40% depending on the service and region. For insurers, these discrepancies can translate directly into mispriced policies and underestimated catastrophe exposures.

Industry
Perspective



“For too long, the insurance industry has managed with poor quality geocoding, resulting in risks inaccurately placed, properties lacking a location, and aggregates understated. Genairate Technologies is changing the nature of location information, allowing more precise understanding of risk and removing the danger of exceeding reinsurance terms.”

-- Head of Data Science at a Major International Insurance Company

A note from GenAirate

In GenAirate's SnapLine platform, we are implementing an optimized geocoding pipeline that combines address validation, multi-provider geocoding selection, parcel boundary augmentation and building footprint integration to achieve rooftop-level accuracy of properties. By embedding this precision geocoding approach within an AI-powered submission management workflow, insurers can transform their ability to identify, analyse and accurately price risk across their portfolio.

Example of Streamlined Underwriting Processes with AI

Fig. 1

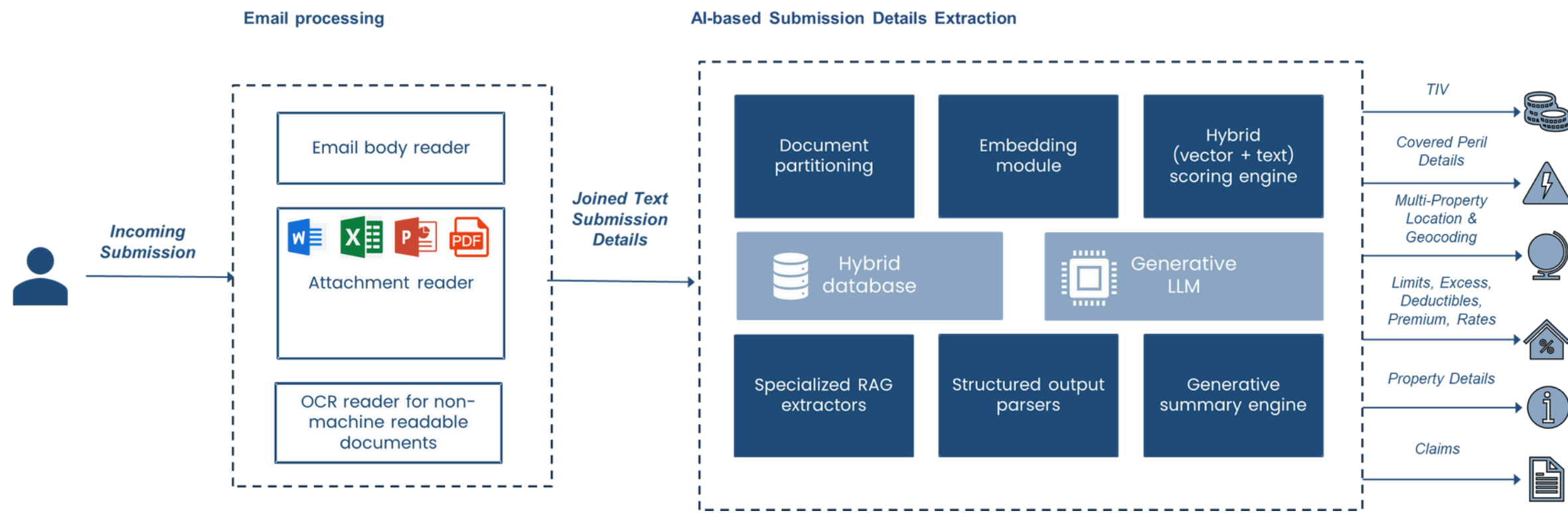


Fig. 1 GenAirate Technologies SnapLine Platform can be fully customised to output rooftop-level accuracy geocoding for insurance underwriting use cases.

Introduction

Geocoding is defined as the computational process of transforming address data into geographic coordinates (latitude and longitude) that can be mapped to specific locations on the Earth's surface. For the insurance industry, the ability to precisely locate insured properties forms the cornerstone of accurate risk assessment across multiple lines of business.

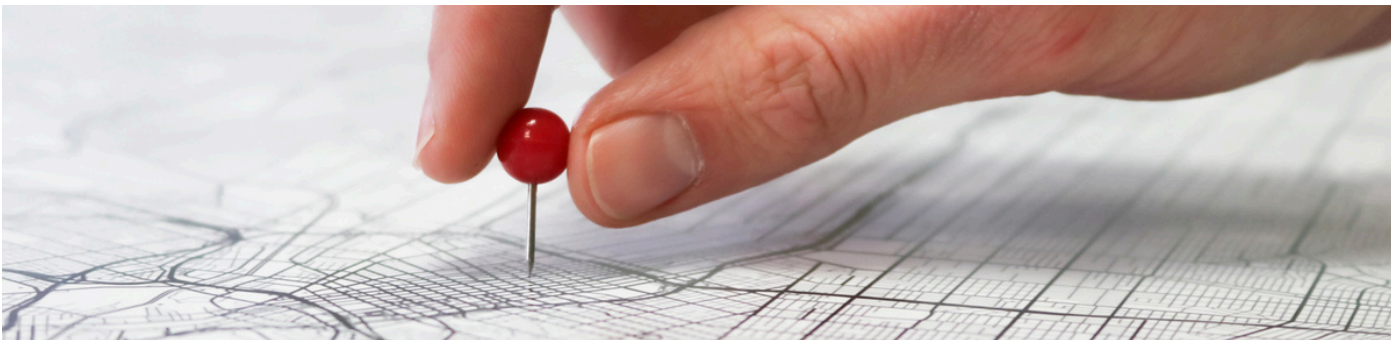
As catastrophe events become more frequent and severe, and as competition drives the need for more granular pricing, the difference between street-level and rooftop-level geocoding accuracy can significantly impact an insurer's performance. Poor geocoding can place properties in incorrect flood zones, misidentify wildfire proximity, or incorrectly assess exposure to other perils, potentially resulting in millions in unexpected losses.

While engagements with individual third-party geocoding services enhance business operations and efficiency, they also introduce risks such as varying levels of precision across different countries. This challenge is particularly acute for global insurers operating across multiple regions.

In today's insurance landscape, the strategic integration of accurate geocoding technologies represents an essential capability for:

- Precise catastrophe modelling and accumulation management
- Accurate underwriting and risk-based pricing

This whitepaper explores how insurers can navigate the complex geocoding landscape, evaluate service providers, and implement a robust geocoding pipeline that delivers the location precision required for competitive advantage in the modern insurance market.



The Role of Location Data in Insurance Risk Assessment

The insurance industry's relationship with location data has evolved dramatically over the past decade. What once involved manual placement of pins on physical maps has transformed into sophisticated geospatial analysis powered by precise coordinates and enriched with third-party data sources.

Historical Evolution of Geocoding in Insurance

Insurance has always been a location-dependent business, but the precision of location data has improved exponentially:

- **1970s-1980s:** ZIP code or postal code level assessment
- **1990s-2000s:** Street-level geocoding emerges
- **2000s-2010s:** Parcel-level data becomes more widely available
- **2010s-Present:** Building footprint and rooftop-level geocoding

Today's most sophisticated insurers leverage coordinates accurate to within meters of the actual building footprint, allowing for precise peril-specific assessments that were previously impossible.

Impact on Key Insurance Functions

Precision geocoding capabilities directly enhance multiple core insurance functions:

- Underwriting and Pricing
 - Accurate flood zone determination
 - Proximity to wildfire zones or fuel sources
 - Distance from coastlines for hurricane/storm surge exposure
- Identification of nearby risks (industrial facilities, high-crime areas)
 - Catastrophe Modelling and Accumulation Management
 - Property-specific exposure assessment
 - Portfolio clustering identification
 - Event response planning
 - Reinsurance purchase optimization

The International Association of Insurance Supervisors (IAIS) Risk-Based Global Insurance Capital Standard, published in October 2024, acknowledges the critical importance of accurate location data in creating resilient insurance operations. This framework emphasizes geospatial technology as a key component of prudent risk management and regulatory compliance.



Current Challenges with Geocoding in Insurance

Despite significant advancements in geocoding technology, insurers face persistent challenges that impact operational efficiency and risk assessment accuracy:

Data Quality and Standardisation Issues

- Address format inconsistencies: Variations in how addresses are written (abbreviations, unit numbers, special characters) directly impact geocoding accuracy
- Multiple addressing systems: Different conventions across countries create complexity for global insurers
- Rural and developing region gaps: Less populated areas often have poor addressing systems and incomplete reference data
- New developments: Recently constructed properties may not exist in geocoding databases

Service Provider Limitations

- Inconsistent accuracy: Based on our evaluation, geocoding services vary dramatically in accuracy by country
- Incomplete coverage: No single provider delivers optimal results across all regions
- Proprietary methodologies: Limited transparency in how coordinates are derived by different geocoding service providers
- Cost-accuracy trade-offs: Higher precision generally comes with increased costs

Risk Assessment Impact

- Misclassification of properties: Incorrect flood zone or wildfire proximity determinations
- Aggregation inaccuracies: Imprecise coordinates create misleading cluster analysis
- Premium inadequacy: Underpriced policies due to missed risk factors
- Customer experience issues: Discrepancies between customer-provided and insurer-determined locations

These challenges create operational blind spots, making it difficult to ensure resilience in a rapidly evolving risk environment.

Geocoding Service Evaluation

Our comprehensive assessment examined four leading geocoding services across seven countries, evaluating 350 addresses (50 addresses per country) for accuracy and reliability. The analysis measured both the average distance from consensus coordinates and the percentage of locations misclassified beyond a 100-meter threshold (misclassified addresses).

Methodology

The evaluation followed a rigorous process:

- Curated a balanced dataset of 350 addresses (50 per country) across urban and rural environments
- Implemented an iterative consensus-based algorithm to establish "gold standard" coordinates
- Calculated Haversine distance between service-provided coordinates and consensus location
- Assessed percentage of coordinates misclassified (outside 100m threshold)
- Manually verified rooftop-level accuracy through visual inspection

Geocoding Service Providers - Map Data and Pricing

Geocoding accuracy is fundamentally tied to the underlying map data that each service relies on. Understanding these foundations and their associated costs is essential for insurers making strategic decisions:

- Google Maps - Proprietary data collected through the Google Service
- Amazon Location Service - Esri and HERE mapping data
- Azure Maps - TomTom mapping data
- Mapbox - OpenStreetMap data augmented with proprietary enhancements



These underlying data sources explain many of the regional performance variations we observed. For example, TomTom (used by Azure) maintains particularly strong data quality in Germany, while Google's proprietary data collection provides superior coverage in the UK and Italy.

Cost and performance data

Fig. 2-3



Fig. 2 Costs of underlying map data

Service	Underlying Map data
Google Maps	<ul style="list-style-type: none">• First 10,000 is Free• 10K-100K: \$5 per 1,000 requests• 100K-500K: \$4 per 1,000 requests• 500K-1M: \$3 per 1,000 requests• 1M-5M: \$1.5 per 1,000 requests• 5M+: 0.38 per 1,000 requests
Amazon Location Service	<ul style="list-style-type: none">• \$ 0.5 per 1,000 requests
Azure Maps	<ul style="list-style-type: none">• \$ 4.50 per 1,000 requests
Mapbox	<ul style="list-style-type: none">• First 500K: \$ 5.00 per 1,000 requests• 500K – 1M: \$ 4.00 per 1,000 requests• 1M+: < \$4.00 per 1,000 requests (contact required for volume pricing)

These underlying data sources explain many of the regional performance variations we observed. For example, TomTom (used by Azure) maintains particularly strong data quality in Germany, while Google's proprietary data collection provides superior coverage in the UK and Italy.

Fig. 3 Country-specific performance data

Service	Mean from centroid (with outliers) [meters]	Mean from centroid (without outliers) [meters]	Number of Points outside 100m threshold	% of points outside 100m threshold
Google	22.51	7.65	2	4%
Amazon	10.63	7.07	6	12%
Azure	294819.57	11.75	10	20%
Mapbox	116.91	10.04	2	4%

Key findings in the UK

Fig. 4-8

Google and Mapbox achieved consistent rooftop-level accuracy across Australia, while Amazon Location Service showed slight offset. Azure demonstrated the poorest performance with 20% of coordinates misclassified. One of the examples is given below.

Fig. 4 Google’s results

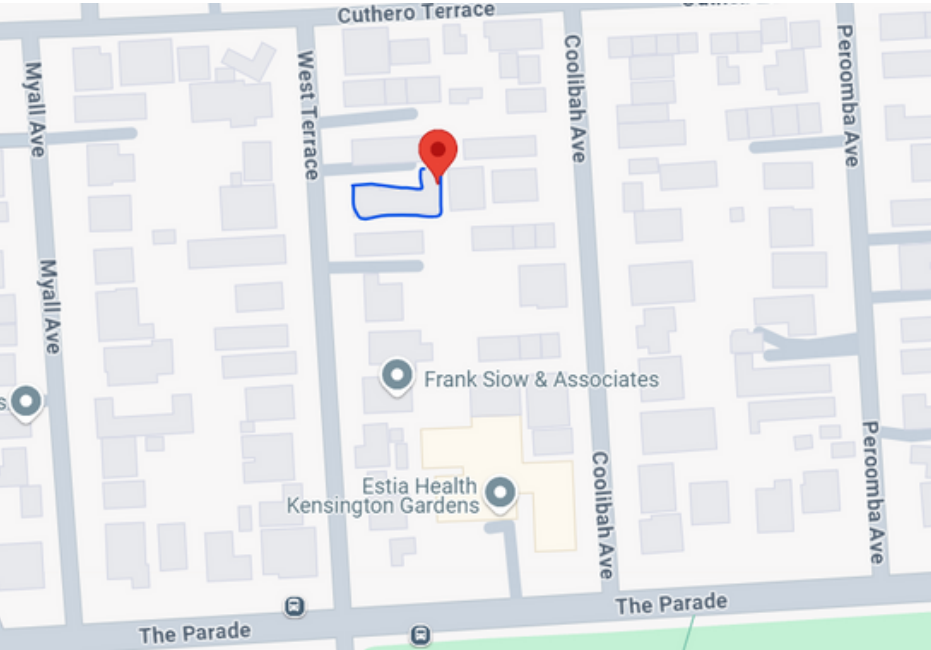


Fig. 5 Amazon Location Service results

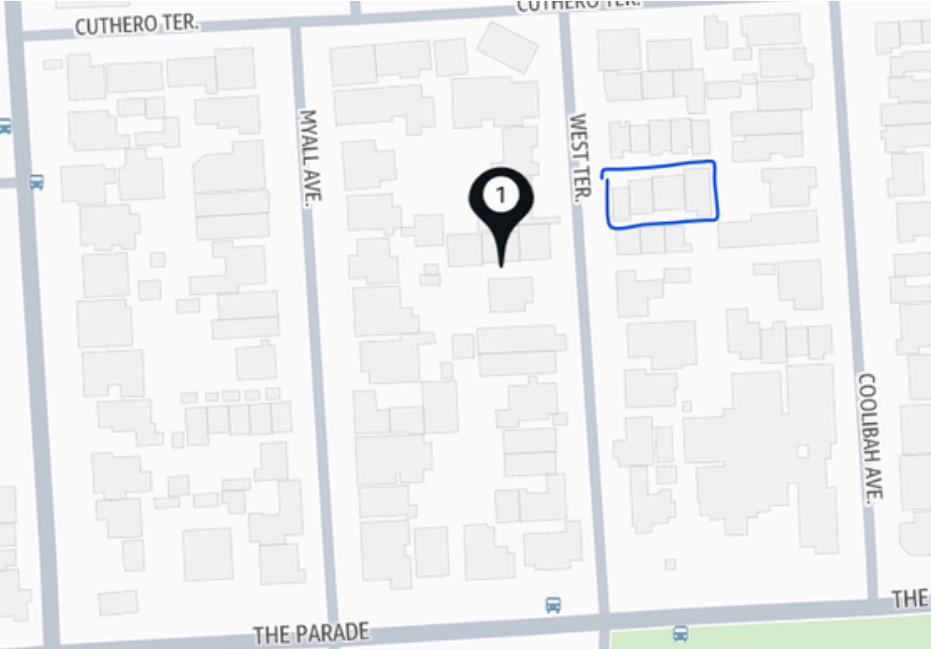


Fig. 6 Azure’s results



Fig. 7 Mapbox’ results



Fig. 8 Rates of inaccuracy

Google achieved exceptional consistency with 0% of points exceeding the threshold. Google also maintained strong performance for complex institutional addresses like schools, while all services struggled with certain address format issues (e.g., abbreviations like "St." vs "Street"), as can be seen in the next test.

Service	Mean from centroid (with outliers) [meters]	Mean from centroid (without outliers) [meters]	Number of Points outside 100m threshold	% of points outside 100m threshold
Google	18.08	15.45	0	0%
Amazon	11.77	11.77	1	1%
Azure	156.75	14.52	5	10%
Mapbox	305.13	12.52	1	2%

Issues with Commercial Addresses

Fig. 9-12 shows the difference between displayed locations for commercial addresses amongst providers.

The address used for this test was Great Meols Primary School, Elwyn Road Wirral District England CH47 7AP.

Fig. 9 Google's results

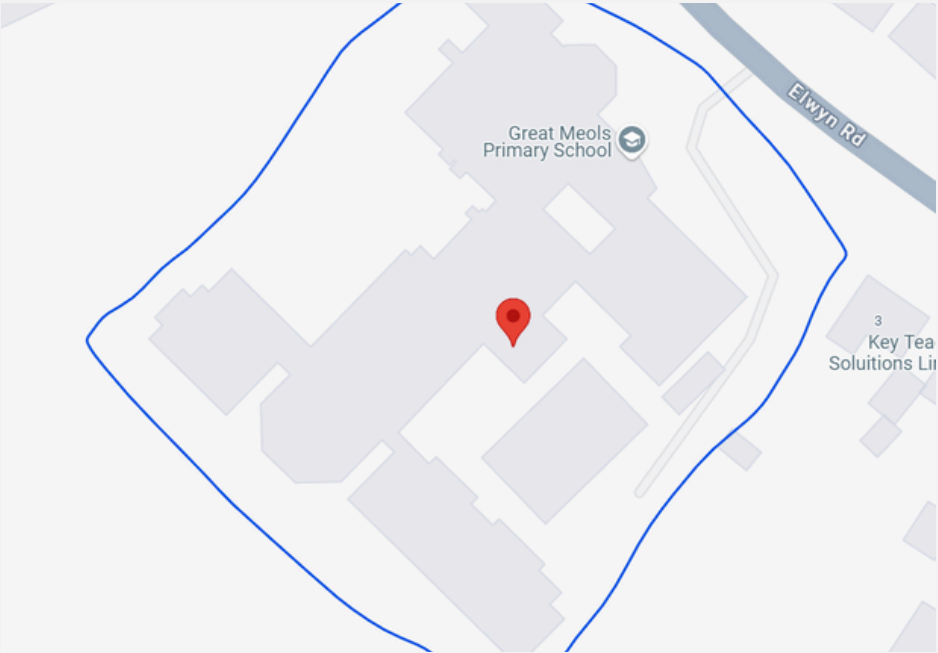


Fig. 10 Amazon Location Service results

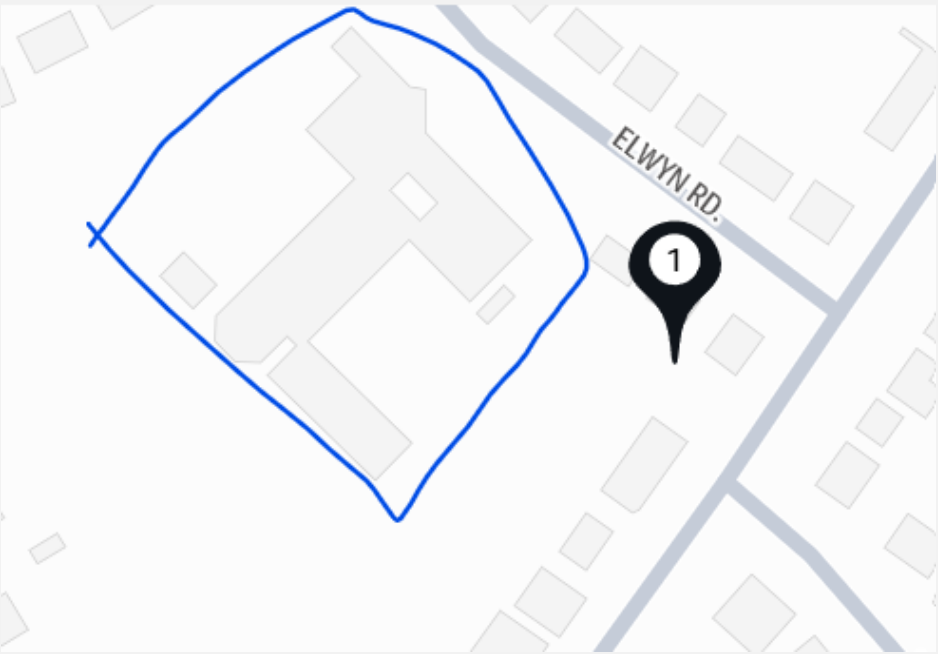


Fig. 11 Azure's results



Fig. 12 Mapbox' results



Key findings in the USA

Fig. 13-17

Mapbox demonstrated the most consistent performance with only 2% of points exceeding the threshold. Google showed superior performance for standard residential addresses but struggled with address typos and formatting errors. One of the examples is given below, where Google, Amazon Location Service and Azure fails to identify a building in a large field, but Mapbox identifies it on rooftop level.

Fig. 13 Accuracy of US geotargeting data

Service	Mean from centroid (with outliers) [meters]	Mean from centroid (without outliers) [meters]	Number of Points outside 100m threshold	% of points outside 100m threshold
Google	42.85	11.64	5	10%
Amazon	20.70	12.63	3	6%
Azure	63.33	16.14	2	4%
Mapbox	20.50	13.19	1	2%

Fig. 14 Google's results



Fig. 15 Amazon Location Service results

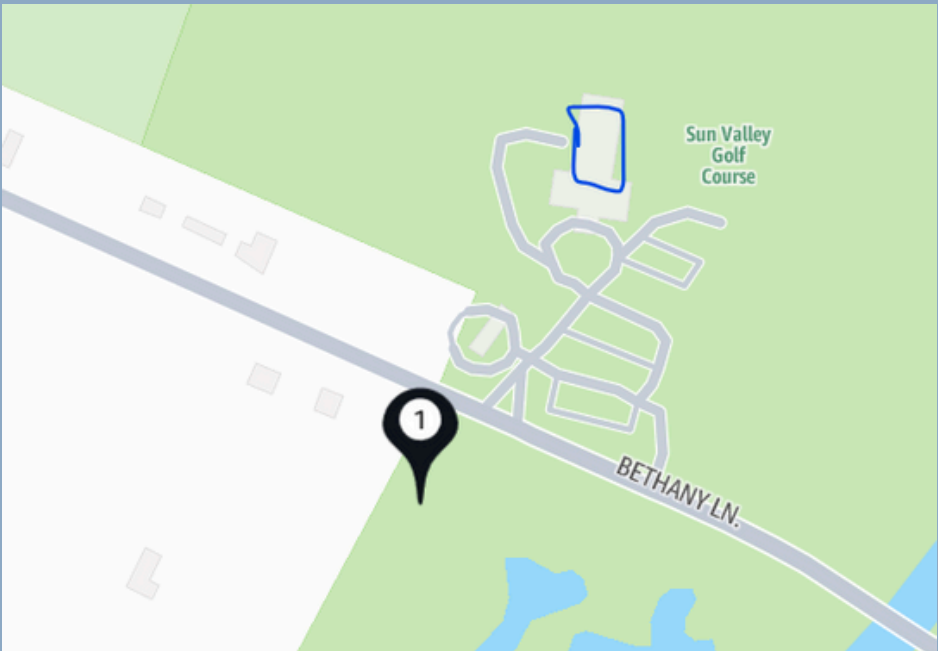
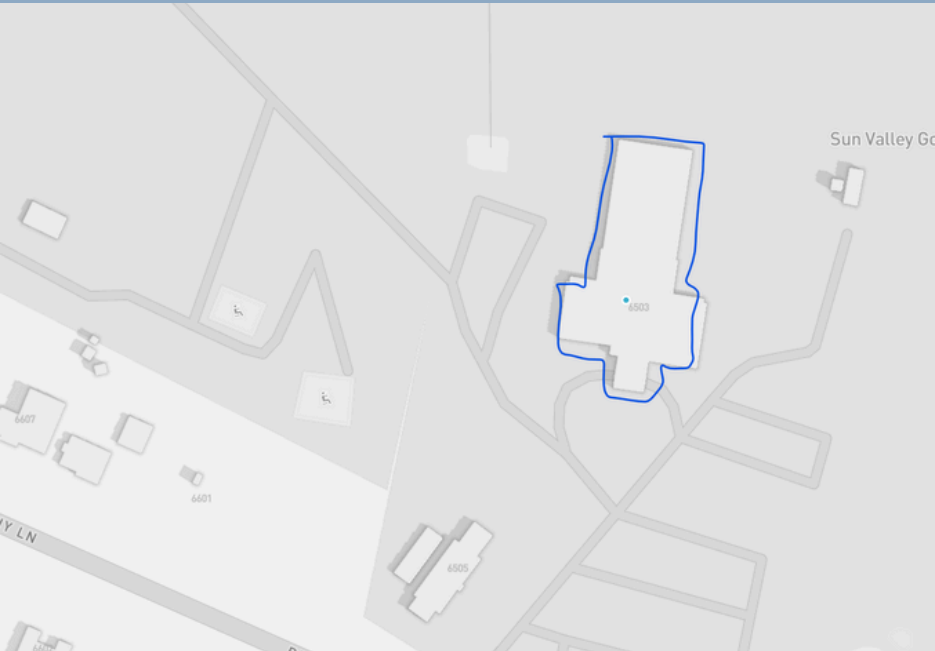


Fig. 16 Azure's results



Fig. 17 Mapbox' results



Performance Summary Across European Countries

We observed significant regional performance variations even between European countries that directly impact insurance applications:

- Spain showed alarmingly poor results across all the four geocoding services evaluated (20-40% error rates)
- France performed best with Amazon Location Service (8% error rate)
- Germany achieved optimal results with Azure and Mapbox (4% error rate)
- Italy performed best with Google (4% error rate)

For insurers operating across the entire European Union, using a single geocoding provider would result in suboptimal accuracy. Instead, a region-specific approach leveraging the best-performing service for each country delivers superior results.

How AI Can Enhance Geocoding Accuracy

Generative AI offers significant potential in improving geocoding accuracy across key areas:

Address Validation and Enhancement

- **Pattern Recognition:** AI models detect and correct address patterns, particularly valuable for non-standard formats
- **Context-Aware Parsing:** Better handling of unit numbers, building names, and complex addressing systems
- **Standardization:** Automatic conversion between abbreviation formats (St./Street, Rd./Road)

Multi-Provider Orchestration

- **Service Selection Optimization:** AI determines the optimal geocoding service based on address characteristics and region
- **Confidence Scoring:** Assigns reliability metrics to coordinates based on consistency across providers
- **Results Reconciliation:** Resolves discrepancies between multiple geocoding results

Feedback Loop Integration

- Learning from Corrections: Models improve over time as adjusters or customers provide location corrections
- Error Pattern Identification: Recognizes systematic inaccuracies in specific regions or address types
- Continuous Improvement: Refines geocoding pipeline based on observed performance

Data Enrichment

- Building Footprint Detection: AI identifies actual building outlines from satellite imagery when traditional geocoding fails
- Property Characteristic Inference: Derives additional risk-relevant details from visual data

However, the adoption of AI for geocoding must be balanced with ethical considerations, data security and regulatory compliance. Collaboration between risk, AI, legal and IT professionals is essential for successful implementation.

Four-Step Geocoding Pipeline for Insurance Applications

Based on our research and industry best practices, we recommend implementing a four-step geocoding pipeline optimized for insurance applications:

Step 1: Address Validation

Preprocessing addresses significantly improves geocoding accuracy by resolving format inconsistencies:

- Apply region-specific validation rules through provider APIs or open-source options like Libpostal
- Standardize abbreviations and correct common typos
- Handle unit/floor numbers appropriately
- Convert between regional address formats as needed

This critical step directly addresses the 20-30% of geocoding failures caused by address formatting issues identified in our testing.



Step 2: Multi-Provider Geocoding

Leverage an optimized provider selection based on our regional performance findings:

- Australia: Google or Mapbox
- Germany: Azure or Mapbox
- France: Amazon Location Service
- UK: Google
- Italy: Google
- US: Mapbox

By implementing service-switching logic based on address characteristics and location, insurers can achieve optimal accuracy while managing costs effectively.

Step 3: Parcel Boundary Augmentation

When geocoding resolves only to street level, parcel boundary data provides critical additional precision:

- Access commercial parcel datasets from providers like CoreLogic, LightBox, or Regrid
- Implement point-in-polygon operations to associate coordinates with specific properties
- Calculate centroids for standardized property representation
- Address multi-property scenarios systematically

This approach directly addresses the street-level placement issues observed in our testing, particularly in Spain and with complex addressing scenarios.

Step 4: Building Footprint Integration

For ultimate precision, especially for complex properties or catastrophe-exposed regions:

- Integrate Microsoft Building Footprints API or similar services for rooftop identification
- Consider specialized insurance-specific sources like EagleView
- Implement machine learning models trained on satellite imagery for regions with poor coverage
- Incorporate customer-provided location refinements when available

Enterprise-Grade Geocoding Solutions for Insurers

Beyond consumer-grade services, several enterprise solutions provide insurance-specific geocoding capabilities:

- CoreLogic: Extensively used by major reinsurers like Swiss Re and Munich Re, offering property-specific focus in the US market
- Verisk: Preferred by AIG and Zurich for its integration with broader risk assessment tools
- Precisely Spectrum: Adopted by Allianz, Zurich, and Aviva for global geocoding needs

These enterprise solutions provide additional advantages for insurers:

- Direct integration with catastrophe models and underwriting systems
- Insurance-specific validation rules and confidence metrics
- Compliance with regulatory reporting requirements
- Historical location data for time-based analysis

Conclusion

AI-driven geocoding solutions are transforming insurance risk assessment by enabling insurers to achieve unprecedented location precision. Our comprehensive analysis reveals that no single provider delivers optimal accuracy across all regions, necessitating a multi-provider approach orchestrated through an intelligent geocoding pipeline.

GenAirate's SnapLine platform empowers insurers to implement this advanced geocoding approach within a broader AI-powered submission management workflow. By combining address validation, provider-specific geocoding, parcel boundary augmentation, and building footprint integration, insurers can overcome the significant accuracy challenges documented in our research.

The precision enabled by this approach delivers tangible business benefits:

- Enhanced catastrophe accumulation management
- More accurate underwriting and pricing

As the insurance industry continues to face growing pressures from climate change, evolving regulatory requirements, and competitive disruption, the strategic advantage of precisely knowing "where" becomes increasingly vital. By investing in advanced geocoding capabilities today, forward-thinking insurers position themselves for superior risk assessment and operational resilience tomorrow.

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- Mapbox Geocoding API – [Mapbox Geocoding API Overview and Documentation](#)
- CoreLogic Location Intelligence Platform – [CoreLogic Location Intelligence](#)
- PRA Rulebook for Catastrophic Risk Management – [PRA Risk Management Rulebook](#)

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