

Geoanalytics for Improved Risk Segmentation in Auto Insurance

By Sanjiv Mishra

Garaging location is a critical rating variable in determining premiums for private passenger automobile insurance. The area where an insured lives affects not just claims for theft, vandalism, and damage from weather (hail, flood, etc.), but it also influences driving behavior. General road conditions, topography, signage, and other distractions can have a profound effect on accidents and the resulting claims. Commute time, distance to shopping centers, availability of public transit, and housing affordability are some of the factors that determine the choice of where to live. Some of those same factors also have a big impact on where, how often, and how far an insured drives. Annual mileage is a strong predictor of risk for auto insurance and is an important rating variable in many rating plans. However, many insurers still rely on self-reported annual mileage estimates provided by their policyholders or agents, with little or no validation.

GIS Applications for Developing Rating Territories

Typically, ZIP codes are used to define territories and establish automobile insurance premiums. However, ZIP code demarcation was designed by the U.S. Postal Service to help deliver mail efficiently. It was not designed to reflect homogeneity of risk characteristics within a ZIP code. Many times, that results in huge differences in premium for people with similar overall risk factors who live on the same street but on opposite sides of the ZIP code line. GIS (geographic information systems) can help overcome this problem using spatial smoothing and clustering techniques to develop rating territories.

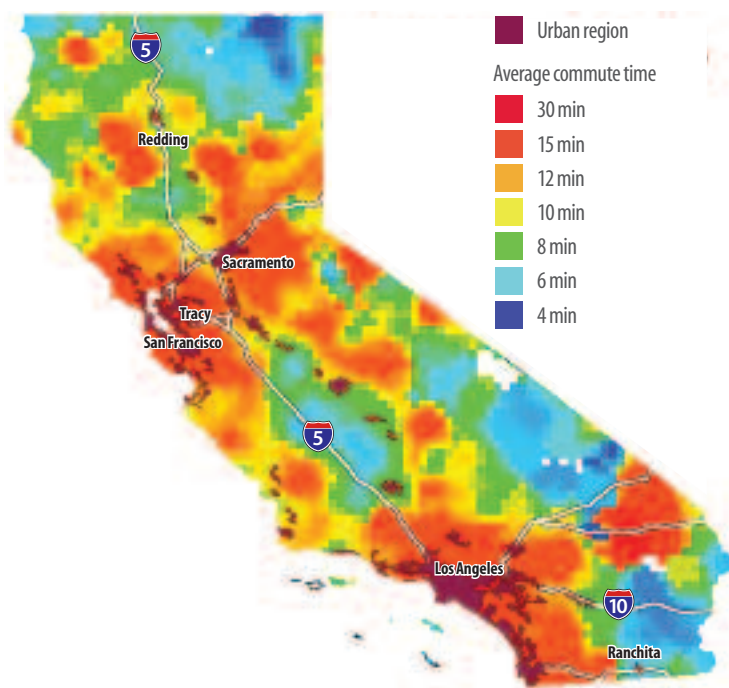
Spatial smoothing uses data from all areas within a set radius from a specific location, weighted by its distance to the center, to achieve the desired level of credibility and to reduce sampling error. Clustering techniques can then be used to develop new rating territories. In addition to its use as an effective analytical tool, GIS is a great communication medium for visualizing analytical results on a map and reaching a wider audience. Figure 1 shows the map for spatially smoothed average commute time in California.

Given the importance of annual mileage in rating, statistical models can help insurers accurately estimate annual miles driven at the time of policy origination and at renewal. Location is important in estimating annual miles driven because it determines commute distance and availability of public transportation. People living in suburbs with poor public transit systems generally drive more compared with people living in urban city centers with good public transit systems. Ignoring those geographic differences will result in inaccurate annual mileage estimates.

Advanced GIS and spatial econometric techniques are useful in analyzing spatial interactions and developing a predictive model that accounts for local factors to determine annual mileage estimates. Table 1 shows the impact of location type, commute distance, and availability of public transit on mileage estimates for a one-driver, one-vehicle household (male, 24 years' driving experience, with a 2002 model year sedan) in different areas where all other factors affecting mileage remain constant.

Figure 1

Average Commute Time in California after Spatial Smoothing



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Table 1

Local Factors Affecting Annual Mileage	Area	Location Type	Public Transport	Mileage Estimate	Notes
(for one-driver, one-vehicle household)	San Francisco	Urban (metro)	Excellent	9,900	Very low or no commute
	Redding	Small city	Good	12,400	Low commute
	Ranchita	Rural	None	15,200	Rural area
	Tracy	Distant suburb	Poor	18,500	Very long commute

GIS Applications for Improved Customer Contact Rates

Another important underwriting application for GIS is to predict best policyholder contact time. Many GIS applications incorporate drive-time simulation algorithms to analyze spatial relationships between locations based on drive time and distance. This can also be used to model an area’s commute distances, which can then be used to develop optimum phone contact strategies.

Using GIS mapping tools, it has been shown that in metropolitan areas, phone contact rates in the evening decrease with the distance from the downtown. This is due to longer commute times to the suburbs. In areas like New York City, this has a major impact. Knowing when a policyholder will be home can dramatically improve an insurer’s contact rate and encourage cost-efficient contact strategies.

Summary

GIS tools have a wide range of applications in insurance. They are extremely useful for improved risk segmentation. Using GIS tools makes it easy to move away from artificial constructs such as ZIP codes and redefine rating territories that are truly representative of the unique risks and exposures within each area. GIS tools can also make an impressive difference in improving the operational efficiencies of call centers. 📄

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