

EV Market Segmentation in India Using Machine Learning: Target Strategy by Income Group

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ML Model Used & Its Role

In this project, Gaussian Mixture Models (GMM) were used for income segmentation. Unlike traditional K-Means clustering, GMM offers flexible clustering boundaries, handles overlapping groups better. Probabilistic assignments, instead of forcing individuals into rigid clusters, it assigns soft probabilities, improving segmentation accuracy. Better for financial data, since income distribution isn't uniform, GMM accommodates varying densities.

Additionally:

- Feature scaling (Standard Scaler) ensured fair contribution from different features.
- Log transformation handled skewness in income values.
- PCA visualization helped understand how income groups were structured.

Overall, GMM proved superior to K-Means for this problem, creating well-defined Low, Medium, and High-Income groups.

Overview of Analysis

- We performed income segmentation using a dataset of household Income and spending in India.
- Utilized Gaussian Mixture Models (GMM) for clustering.
- Included income, disposable income, and desired savings as key factors.
- Categorized individuals into three distinct income groups.

Key Findings

Income Group	Number of People	Characteristics
Low Income	10,373	Limited savings and disposable income, likely price sensitive.
Medium Income	7,638	Moderate earnings, decent disposable income—potential target for mid-range EVs.
High Income	1,634	High earnings, strong savings—ideal buyers for premium EVs.

High-income group (~1,634 people)

- Earn significantly more.
- Self-employed or professionals, mostly from Tier 1 & Tier 2 cities.
- Strong disposable income (~₹31,617) → Ideal buyers for premium EV models (luxury SUVs & sedans).

Medium-income group (~7,638 people)

- Largest segment across all city tiers.
- Disposable income (~₹13,891), indicating potential for affordable EVs.
- Strong demand in Tier 2 & Tier 3 cities.
- Needs financing options and government subsidies to boost adoption.

Low-income group (~10,373 people)

- Earn ~₹26,858 median income, limited disposable income (~₹9,676).
- Highly price-sensitive—mostly in Tier 3 cities.
- Not an ideal EV-buying group but could benefit from EV rental or low-cost financing options.

Improvements with More Time & Budget

Enhanced Data Collection: Given more time and budget, additional datasets should be collected for deeper segmentation.

Vehicle ownership history → Helps understand willingness to shift to EVs.

Loan/credit history → Determines ability to finance EV purchases.

Commute patterns → Identifies demand for battery range optimization.

Environmental preferences → Helps promote eco-conscious marketing.

EV subsidy awareness & incentives → Determines how financial aid impacts adoption.

Better ML Models to Try:

- Hierarchical Clustering → Dynamically creates different clusters based on distance metrics.
- Random Forest or XGBoost Classification → Predict likelihood of EV adoption based on socioeconomic factors.
- DBSCAN → Detects natural density-based clusters that might not fit conventional segmentation.
- These models would strengthen EV adoption strategies, making targeting more precise.

Estimated Market Size for EVs in India

The Indian EV market is rapidly growing, with an estimated market value of ₹50,000 Crores (~\$6 billion) by 2025. EV penetration is expected to reach 30% by 2030, driven by policies like FAME-II subsidies. Annual EV sales projected to cross 1.5M units by 2025. Two-wheelers dominate the EV market (~60% share) due to affordability.

This means EV startup is a fast-expanding domain with strong growth potential.

Strategic Solution Based on Findings

Recommended Business Strategy:

- **Premium EVs** for Tier 1 & Tier 2 buyers (High-Income group) → Focus on performance, battery life, charging networks.
- **Affordable EVs** for Tier 2 & Tier 3 cities (Medium-Income group) → Provide budget-friendly models with loan & subsidy options.
- **Shared mobility** (EV rentals, subscriptions) for Low-Income group → Encourage trials, making adoption less risky.
- **Leverage government incentives** (FAME-II, GST reductions) to make EVs more accessible.
- With these strategies, EV startup can tap into the right income segments and maximize EV adoption.

