Improving Spain's High-Speed Railroad

Group 12: Kyle Lew, Andriy Uspishnyi, Tim Christian, Ben Laufer, Roee Morag

Motivation

Two Major Initiatives:

I. To create customer transparency within the ticket selling operation.

II. To identify new expansion cities for the Spanish High-Speed Rail System:

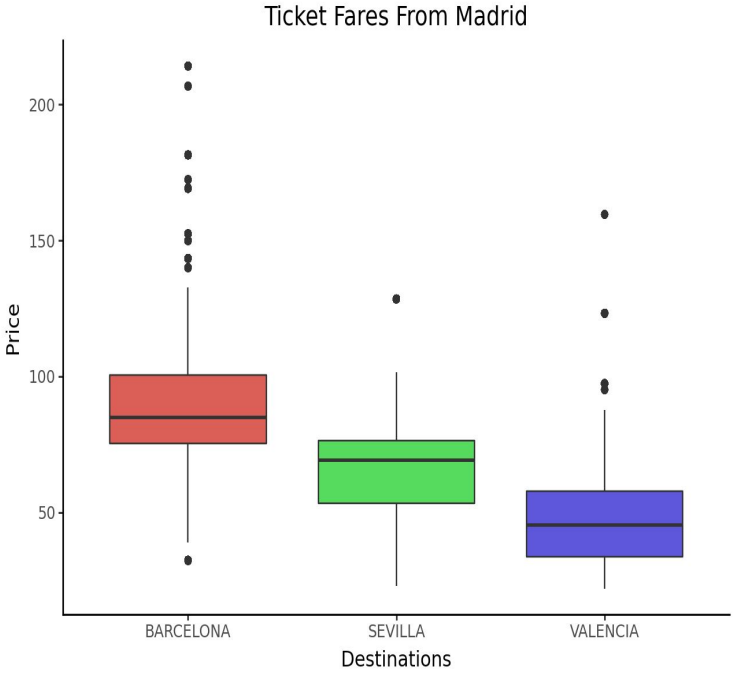
- Malaga and Vigo due to demographics and distance from metropolitan centers.

Variable Selection

Variables Selected for the model:

- Travel Class
- Day of the Week
- Time of the Day
- Trip Duration
- Population of the Origin/Destination
- Cost of Living at the Origin/Destination

We selected these variables due noticeable changes in R^2 with changes in the above variables.



Recommendation #1

Estimate ticket fares for future customers!

This model allows customers to estimate what a ticket might cost for a future trip depending on...

- Origin and destination
- Date and time
- Ticket class

SMART customers can see what is the potential price range for ticket fares. By implementing this model on the back-end of a user-interface for trip planning, customers can reliably and instantly plan trips and expenses.

Tickets by class	Turista	Turista Plus	Preferente
Madrid → Barcelona	€ 90.16	€94.55	€112.39

Final model selected based on the highest R^2: KNN (N-Neighbors = 25, R^2= 0.827)
(Other models considered: Elastic Net, Ridge, and Lasso Regressions)

Recommendation #2

Expand your transit network and predict ticket fares for new cities!

Use our pricing model to estimate accurate ticket prices for new destinations, based on:

- Origin/Destination
- Time of travel
- Ticket Class
- Fare Type

In combination with client information on estimated market demand and operating costs, the output of this model can also be used for more accurate revenue predictions, efficient budget planning and marketing promotion.

Final model selected based on the highest R^2: KNN (N-Neighbors = 25, R^2= 0.878)
(Other models considered: Elastic Net, Ridge, and Lasso Regressions)

Example:
Fare predictions for new cities on route

Time: Monday Morning
Class: 'Turista'
Fare: 'Promo'

Vigo & Malaga pricing to/from Madrid

Predicted Ticket Prices		DESTINATION		
		Vigo	Malaga	Madrid
ORIGIN	Vigo		€ 83.55	€ 60.30
	Malaga	€ 85.10		€ 60.30
	Madrid	€ 54.00	€ 54.00	

Vigo & Malaga pricing to/from Sevilla

Predicted Ticket Prices		DESTINATION		
		Vigo	Malaga	Sevilla
ORIGIN	Vigo		€ 83.55	€ 83.55
	Malaga	€ 85.10		€ 41.70
	Sevilla	€ 85.10	€ 30.60	

Suggested Use and Further Actions

Examine the primary factors influencing ticket pricing for Spain's high-speed rail system.

- **Revenue Optimization:** Understanding pricing factors allows for dynamic pricing strategies, maximizing revenue during peak demand periods.
- **Cost Management:** Identifying key cost drivers helps streamline operations and improve profit margins.

Identify the “DNA” of customer preference for frequent use of high-speed rail services in Spain.

- **Targeted Customer Engagement:** Develop solutions focused on enhancing targeted customer engagement to meet specific needs (e.g. Membership Pass)
- **Market Differentiation:** Addressing customer needs helps builds customer loyalty and effectively positions the service as the preferred travel option over competitors.

ETHICAL USE & COMPLIANCE RECOMMENDATION

Promote Fairness and Transparency:
Ensure the pricing model is used to deliver equitable fare recommendations, avoids discriminatory practices, and clearly communicates pricing factors such as origin, destination, and ticket class.

Implement Robust Accountability Measures: Establish an internal review board for the model outputs, conduct regular audits, and integrate customer feedback mechanisms to maintain ethical and regulatory compliance.

Eliminate Bias and Enhance Inclusivity:
Regularly test the model to address biases, ensuring affordability and accessibility for diverse passenger groups, including seniors, students, and low-income travelers.

Uphold Data Privacy and Compliance:
Adhere to strict privacy standards and ensure compliance with transportation, consumer protection, and data protection laws like GDPR and CCPA.