

Software Requirements Specification (SRS)

Project Title: House Value Prediction System for California Real Estate Agency

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1. Introduction

1.1 Purpose

This document outlines the software requirements for a machine learning (ML) system designed to predict the market value of residential properties in California. Commissioned by a real estate agency, the goal is to enhance the accuracy and efficiency of property valuation processes.

1.2 Scope

The system will provide property value predictions using a supervised ML model trained on historical property data, including expert estimations. The system will expose a user-friendly interface and an API to allow agents to input property data and receive valuation predictions.

1.3 Definitions, Acronyms, and Abbreviations

- **ML:** Machine Learning
 - **API:** Application Programming Interface
 - **MAE:** Mean Absolute Error
 - **MAPE:** Mean Absolute Percentage Error
 - **RMSE:** Root Mean Square Error
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2. Overall Description

2.1 Product Perspective

The system is a software solution that integrates with client data sources. It comprises:

- A backend ML engine for prediction
- A RESTful API for data communication
- A web-based frontend for internal users (real estate agents)

2.2 Product Functions

- Accept property feature input and return estimated value.
- Train model on historical data with expert estimations.
- Retrain model with new data.
- Track prediction accuracy and provide performance metrics

2.3 User Characteristics

- **Real estate agents:** Basic computer skills; use the interface to input data and receive predictions
- **ML engineers:** Responsible for model lifecycle management, retraining, and monitoring.

2.4 Constraints

- The dataset contains expert estimations with a known average error of ~20%.
- Predictions must be returned within 2 seconds.
- Must comply with California data privacy laws.

2.5 Assumptions and Dependencies

- Data provided is representative of the housing market.
- The system relies on stable internet connectivity for API and frontend access

3. Specific Requirements

3.1 Functional Requirements

- **FR1:** The system shall be initially trained using the provided dataset.
- **FR2:** The system shall accept property feature inputs via the UI and API.
- **FR3:** The system shall return a predicted value with an associated confidence score.
- **FR4:** The system shall log all prediction inputs and results.
- **FR5:** The system shall support scheduled and event-based model retraining.

3.2 Non-Functional Requirements

- **NFR1:** The system shall maintain a prediction error rate below 20%.
- **NFR2:** The system shall return prediction results within 2 seconds.
- **NFR3:** The system shall be deployed in a secure, scalable cloud environment.
- **NFR4:** The user interface shall be intuitive and accessible to non-technical users.
- **NFR5:** The system shall support version control for both models and data.

3.3 External Interface Requirements

- **User Interface:** A responsive web interface for data input and visualization.
 - **API Interface:** RESTful endpoints for system integration and automation workflows.
 - **Data Interface:** Input from CSV files and database connectors for model training and logging.
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4. Appendices

4.1 Input Data Format

Column Name	Description
Median_House_Value	Median house value for household within a block (measured in USD) [prediction target]
Median_Income	Median income for households within a block of houses (measured in tens of thousands of USD) [10k\$]
Median_Age	Median age of a house within a block; a lower number is a newer building [years]
Tot_Rooms	Total number of rooms within a block
Tot_Bedrooms	Total number of bedrooms within a block
Population	Total number of people residing within a block
Households	Total number of households, a group of people residing within a home unit, for a block
Latitude	A measure of how far north a house is; a higher value is farther north [°]
Longitude	A measure of how far west a house is; a higher value is farther west [°]
Distance_to_coast	Distance to the nearest coast point [m]
Distance_to_LA	Distance to the centre of Los Angeles [m]
Distance_to_SanDiego	Distance to the centre of San Diego [m]
Distance_to_SanJose	Distance to the centre of San Jose [m]
Distance_to_SanFrancisco	Distance to the centre of San Francisco [m]

4.2 Model Evaluation Metrics

- **MAE (Mean Absolute Error):** Measures average absolute difference between predicted and actual prices
- **RMSE (Root Mean Square Error):** Penalizes larger errors more heavily than MAE
- **MAPE (Mean Absolute Percentage Error):** Provides error in percentage terms for business interpretability