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Forecasting UK house prices with machine learning

Submitted in partial requirements for the degree of

However, to fill in other details.

# ACKNOWLEDGEMENT

First, I am thankful to

# Table of Figures

# Abstract

This thesis aims

# INTRODUCTION

## 1.1 Background and Motivation

The background and motivation to study UK housing price forecasting stems from the importance of understanding and predicting the trends and fluctuations in the housing market. The housing market plays a significant role in the overall economy, impacting individuals, businesses, and policy decisions.

By studying UK housing price forecasting, researchers and analysts aim to gain insights into the factors that influence housing prices, such as supply and demand dynamics, economic indicators, demographic changes, government policies, and external factors like global events and crises. Understanding these factors and their impact on housing prices can provide valuable information for individuals and businesses involved in the real estate industry, as well as policymakers and investors.

Forecasting housing prices can help individuals make informed decisions about buying or selling properties, as well as inform businesses in the construction and real estate sectors about market conditions and investment opportunities. Policymakers can also use housing price forecasts to assess the health of the housing market, monitor economic stability, and design appropriate policies to address potential housing market challenges or imbalances.

Moreover, studying UK housing price forecasting can contribute to a broader understanding of macroeconomic trends and the dynamics of the housing market. It can provide insights into the interconnections between the housing market and other sectors of the economy, such as finance, employment, and consumer spending. This knowledge can help in the formulation of economic models and policymaking that aim to promote sustainable economic growth and stability.

Residential housing is vital in our lives as it provides us a place to call home. Whether it's after a long day at work, during travel, or simply when we need a break, having a home is essential to everyone. Homes can be located in urban or suburban areas, depending on individual or family preferences, and can range from a single room in a shared house to a grand mansion with various amenities such as gardens and swimming pools. The value of homes varies based on factors like location, size, age, and economic conditions, and these values also change over time.

For many of us, purchasing a home is driven by two main factors: lifestyle and investment. Homeownership is seen as both a way to enhance our way of living and as a financial investment. There is a belief, supported by Monnery (2011), that house prices generally increase in the medium to long term, and that a temporary fall in prices presents an opportunity to enter the housing market. Houses are considered suitable investments because their prices grow faster than inflation rates.

However, in the current rapidly changing world, especially with the uncertainty brought by global pandemics like COVID-19, it is worth questioning whether the long-held belief in the value of houses will continue to hold in the future.

Considering the average income in the United Kingdom, which is around £38,600 for full-time jobs and £13,803 for part-time employment (Office of National Statistics, 2021a), the estimated after-tax earnings based on the gov.uk tax service calculator are £29,889 and £13,027 respectively. Assuming a 40-year working career, these incomes would generate an estimated lifetime after-tax income of £1,195,592 and £521,113, respectively, in today's money.

Despite a slight decrease (0.2%) in house prices since the first quarter of 2020, the housing market in the United Kingdom has experienced an annual increase of 2.1%. UK is currently valued at £231,885 (HM Land Registry, 2020). This demonstrates that many of our working lives are dedicated to accumulating the wealth needed to become homeowners. Owning a home is more achievable for individuals earning around the average full-time income mentioned earlier, compared to those with part-time incomes. Therefore, individuals earning around the average part-time income are less likely to be homeowners, given the current value of properties in the UK.

A table with numbers and a number on it

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Figure : Average prices in England

## 1.2 Research

This passage discusses the determination of house prices in the UK, highlighting that it involves both an art and a science. The estimation of house prices takes into account various factors, including tangible factors such as floor area, number of bedrooms, and air quality, as well as intangible factors like greenery, views, and prestige. Other factors influencing house prices include the presence of roads, access to social amenities, and the overall neighbourhood. Additionally, macroeconomic factors like liquidity, income levels, cost of capital, inflation, and GDP also play a role in estimating house prices.

Previous research has explored these factors and their impact on house prices using machine learning. Authors have utilized different approaches, such as focusing on a few factors with a single machine learning algorithm or incorporating multiple algorithms with varying combinations of factors. These studies have provided insights into how different machine learning algorithms perform and how the factors can positively, negatively, or neutral affect house price estimation.

One challenge is that some parameters used in machine learning models exist in a static continuum, such as the physical properties of houses and neighbourhood amenities. In contrast, others, like economic metrics, vary over time. Therefore, it is crucial to consider all known factors and parameters in a framework that allows for using new or existing machine learning algorithms to estimate house prices accurately. The terms "factors" and "parameters" are used interchangeably in this thesis to represent the variables in the datasets analysed.

Research Questions:

* 1. How are house prices estimated using data-driven methods, and what factors, including house characteristics and neighbourhood features, impact these prices?
  2. Can machine learning be applied to analyse the influence of different factors on house price estimation, and what methods are employed to evaluate research focusing on house price estimation?

## 1.3 Contribution

Yet to fill

## 1.4 Thesis structure

Yet to fill

## 1.5 Conclusion

This chapter discusses about the motivation for doing this research and background for it, it also discusses about research questions and the contribution made.

# LITERATURE REVIEW

## 2.1 Background

### 2.1.1 Introduction

### 2.1.2 Types of variables used

### 2.1.3 Machine learning

A diagram of a software development process

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Figure : Machine learning workflow

## 2.2 Literature Review approach

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### 2.4.1 Characteristics of houses

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## 2.5 Models used in forecasting

## 2.6 Existing work done in relevant field

## 2.7 Comparison in Owning vs Renting

## 2.8 Research gap and conclusion

# METHODOLOGY

3.1 Introduction

3.2 Framework

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