

# Designing Resilient AI-based Robo-Advisors: A Prototype for Real Estate Appraisal

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**Abstract.** For most people, buying a home is a life-changing decision that involves financial obligations for many years into the future. Therefore, it is crucial to realistically assess the value of a property before making a purchase decision. Recent research has shown that artificial intelligence (AI) has the potential to predict property prices accurately. As a result, more and more AI-based robo-advisors offer real estate estimation advice. However, a recent scandal has shown that automated algorithms are not always reliable. Triggered by the Covid-19 pandemic, one of the largest robo-advisors (Zillow) bought houses overvalued, eventually resulting in the dismissal of 2,000 employees. This demonstrates the current weaknesses of AI-based algorithms in real estate appraisal and highlights the need for troubleshooting AI advice. Therefore, we propose to leverage techniques from the explainable AI (XAI) knowledge base to help humans question AI consultations. We derive design principles based on the literature and implement them in a configurable real estate valuation artifact. We then evaluate it in two focus groups to confirm the validity of our approach. We contribute to research and practice by deriving design knowledge in accordance with a unique artifact.

**Keywords:** Robo-Advisors · House Price Prediction · Resilience · Explainable Artificial Intelligence

## 1 Introduction

Buying a house is one of the major life events of a person [13]. One of the most important questions is whether a house is appropriately valued, i.e., the house is offered within a price range that reflects its assets and is comparable to similar houses in terms of characteristics of the property and its surroundings. Due to the manifold factors impacting a property's value, its correct appraisal is challenging [9]. Therefore, more and more companies provide AI-based support, so-called robo-advisors, in real estate appraisals. The latest business model extension is that robo-advisors use their own appraisal algorithms to buy and sell houses (called iBuyer). One of these iBuyers, Zillow, experienced an external shock in the Covid-19 pandemic due to over-reliance on their AI advice. The AI systematically overvalued houses offered for sale on the market resulting in







Fig. 1. The graphical user interface of the proposed prototype.

realistic. In addition, further examples provide insights into the knowledge base of the AI. The user can interactively select as many examples as desired.

### 3 Evaluation and Outlook

To evaluate the prototype, we used exploratory focus groups [15]. In general, focus groups are valuable for design research projects because they allow for direct interaction with respondents and for collecting large amounts of rich data [15]. In addition, exploratory focus groups aim to generate formative feedback for artifact refinement. We used a digital whiteboard to capture and structure the feedback. Our goal was to discuss the usefulness of the proposed DFs and thereby generate feedback for the refinement of the artifact. For the selection of the participants, we used purposeful sampling [14]. We searched for participants that have knowledge of human-AI collaboration and are at a representative age for buying a house. In total, 13 participants and two researchers participated in two sessions. We conducted two focus groups, one with a smaller group to facilitate more extensive exchange and one with a focus on collecting broad ideas. For both focus groups, the moderator was one of the primary researchers. Each session lasted 90 minutes. We first demonstrated the prototype to the participants during each session and led them through the different options using a click-through approach. Then, we let them freely use the prototype on their own. Next, we iteratively discussed three prediction examples, each with varying prediction quality. After each property, we collected feedback in a structured way by asking the participants to note down how the specific DF helped them. Afterward, we disclose the actual market value and ask for feedback again. In the first focus group, one participant criticized the difficult interpretation of

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