Data Analysis and Machine-Learning

Chapter 11.4.

*Interaction Effect Analysis– Application*



1. Introduction

Typically, linear regression model is designed to test the linear relationship between the variables. In this context, interaction effect can be useful for testing the possible non-linear relationship in a linear model.

The basic conceptualization of the model is as follows.

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2. Application

Hypothesis:

(1) The increasing number of floors will result in increasing house prices.

(2) Together with the effects of the number of floors (and even if the numbers of house floors are the same), if the house has a pool attached to it, the house price will increase even further.

As the following result (with bootstrapping of 1000 samples) implies, the first hypothesis is supported as the beta coefficient for floors remain statistically significant; and the second hypothesis is also supported as the interaction term is statistically significant.

**Results**

**Linear Regression**

| Model Fit Measures | | | | | |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| **Model** | | **R** | | **R²** | |
| 1 |  | 0.369 |  | 0.136 |  |
|  | | | | | |

| Model Coefficients - price | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
| **Predictor** | | **Estimate** | | **SE** | | **t** | | **p** | |
| Intercept ᵃ |  | 281471 |  | 6855 |  | 41.06 |  | < .001 |  |
| floors |  | 167489 |  | 4317 |  | 38.79 |  | < .001 |  |
| waterfront: |  |  |  |  |  |  |  |  |  |
| 1 – 0 |  | 502206 |  | 84058 |  | 5.97 |  | < .001 |  |
| floors ✻ waterfront: |  |  |  |  |  |  |  |  |  |
| floors ✻ (1 – 0) |  | 367638 |  | 48574 |  | 7.57 |  | < .001 |  |
| ᵃ Represents reference level | | | | | | | | | |
|  | | | | | | | | | |

**Assumption Checks**

| Collinearity Statistics | | | | | |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
|  | | **VIF** | | **Tolerance** | |
| floors |  | 1.01 |  | 0.992 |  |
| waterfront |  | 9.81 |  | 0.102 |  |
| floors ✻ waterfront |  | 9.83 |  | 0.102 |  |
|  | | | | | |

**Moderation [with Bootstrapping(1,000 samples)]**

| Moderation Estimates | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |
|  | | **Estimate** | | **SE** | | **Z** | | **p** | |
| floors |  | 6.69e-6 |  | 4.54e-7 |  | 14.73 |  | < .001 |  |
| waterfront |  | 1.11e-6 |  | 9.27e-8 |  | 12.00 |  | < .001 |  |
| floors ✻ waterfront |  | 2.75e-7 |  | 3.62e-8 |  | 7.59 |  | < .001 |  |
|  | | | | | | | | | |