

# Tune Boosting Algorithms and Interpret Feature Importances



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# Hyperparameter Tuning



# Hyperparameters

**Model configuration properties that define a model and remain constant during the training of the model.**



# Hyperparameters

**Part of the model design.**



# Understanding Hyperparameters

**Model Inputs**

**Model Parameters**

**Model  
Hyperparameters**



# Understanding Hyperparameters

## Model Inputs

Training data from  
which the model learns

## Model Parameters

## Model Hyperparameters



# Understanding Hyperparameters

## Model Inputs

Training data from  
which the model learns

## Model Parameters

Model coefficient and  
intercept

## Model Hyperparameters



# Understanding Hyperparameters

## Model Inputs

Training data from  
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## Model Parameters

Model coefficient and  
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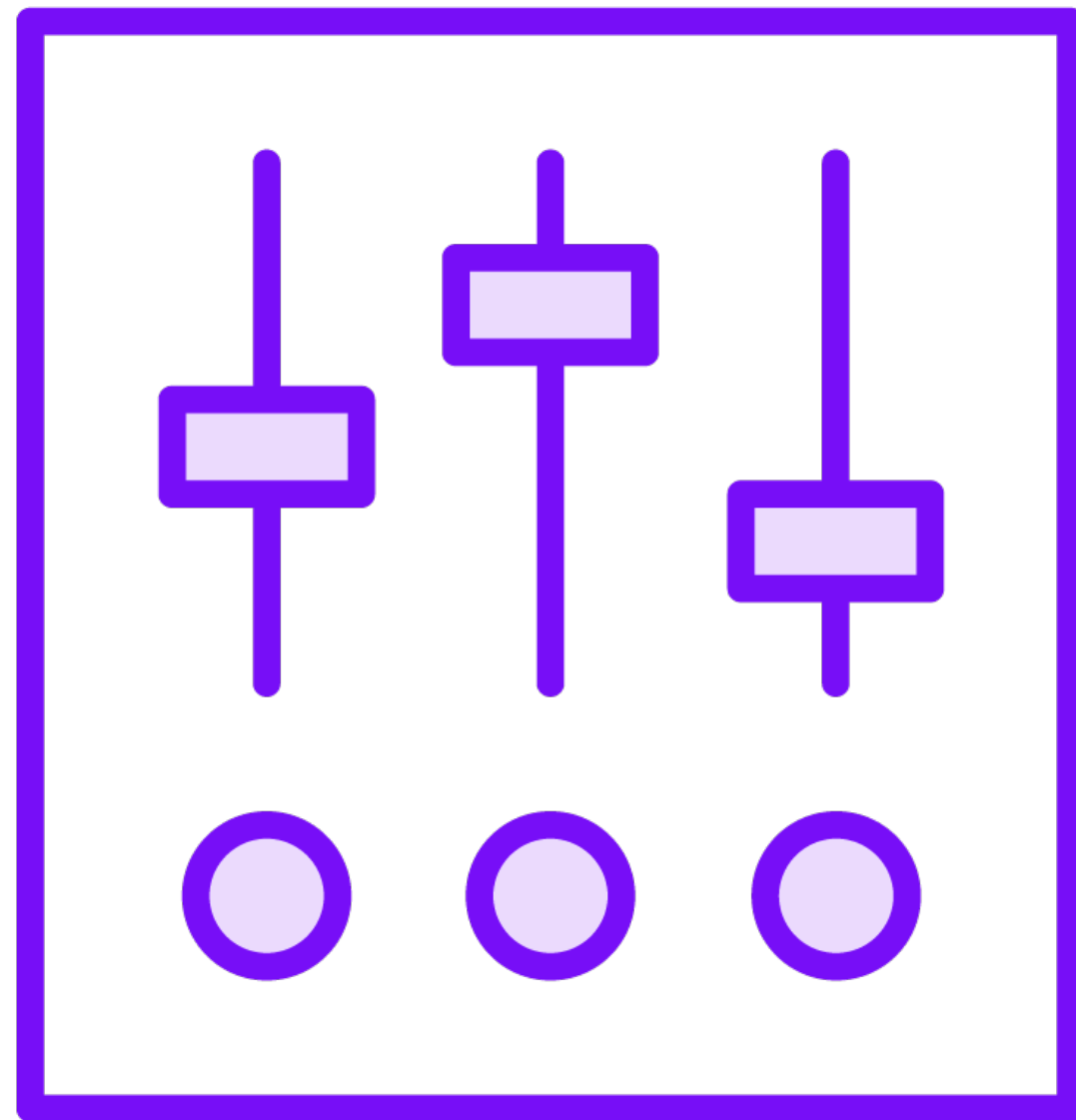
## Model Hyperparameters

Depth of the decision  
tree, alpha for  
regularization





# What Is Hyperparameter Tuning?



Finding the best settings

Optimizing model performance

Iterative process





# **Feature Importances with SHAP Values**

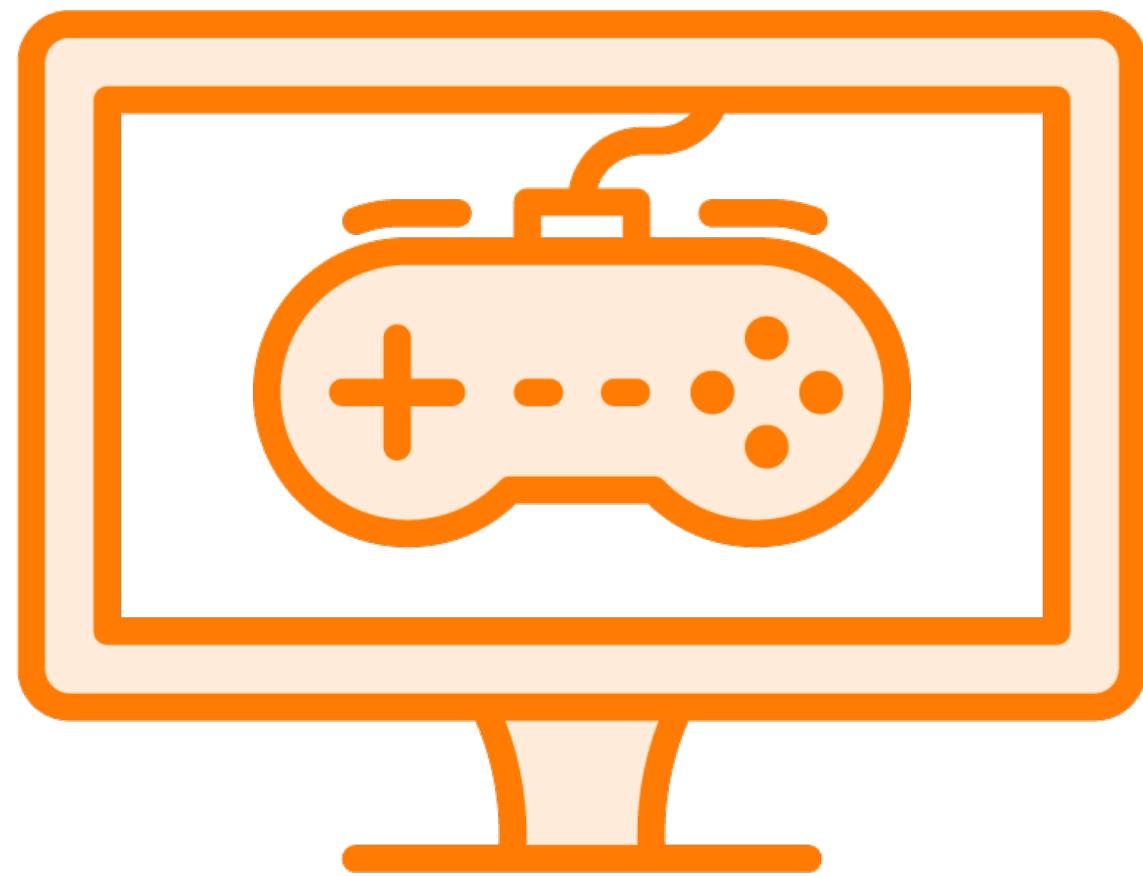


# SHAP (SHapley Additive exPlanations)

Quantify how much each feature contributes to a specific prediction made by a machine learning model.



# Based on Game Theory



Derived from Shapley values in cooperative game theory

Each prediction is a game that requires team effort - each feature is a member of the team

How much did each feature “contribute” to this individual prediction?



# Predicting Home Price: Computing SHAP Values

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**Final prediction:  
\$450K**

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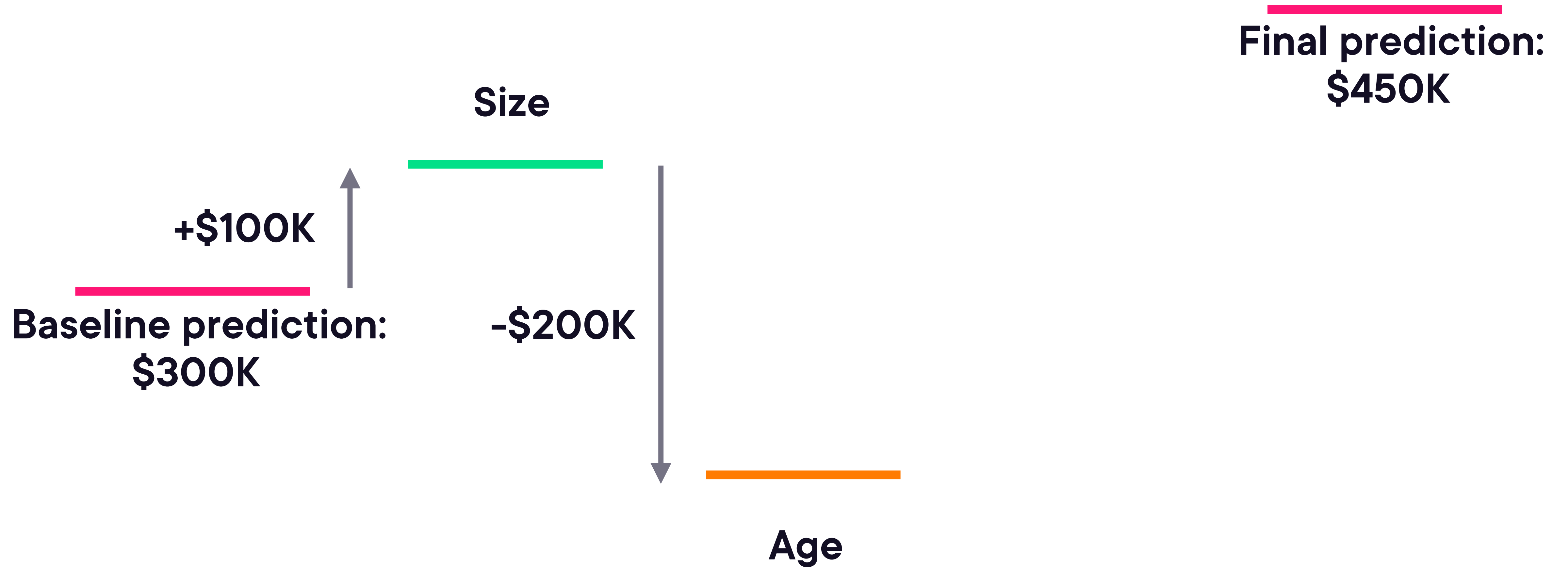
**Baseline prediction:  
\$300K**



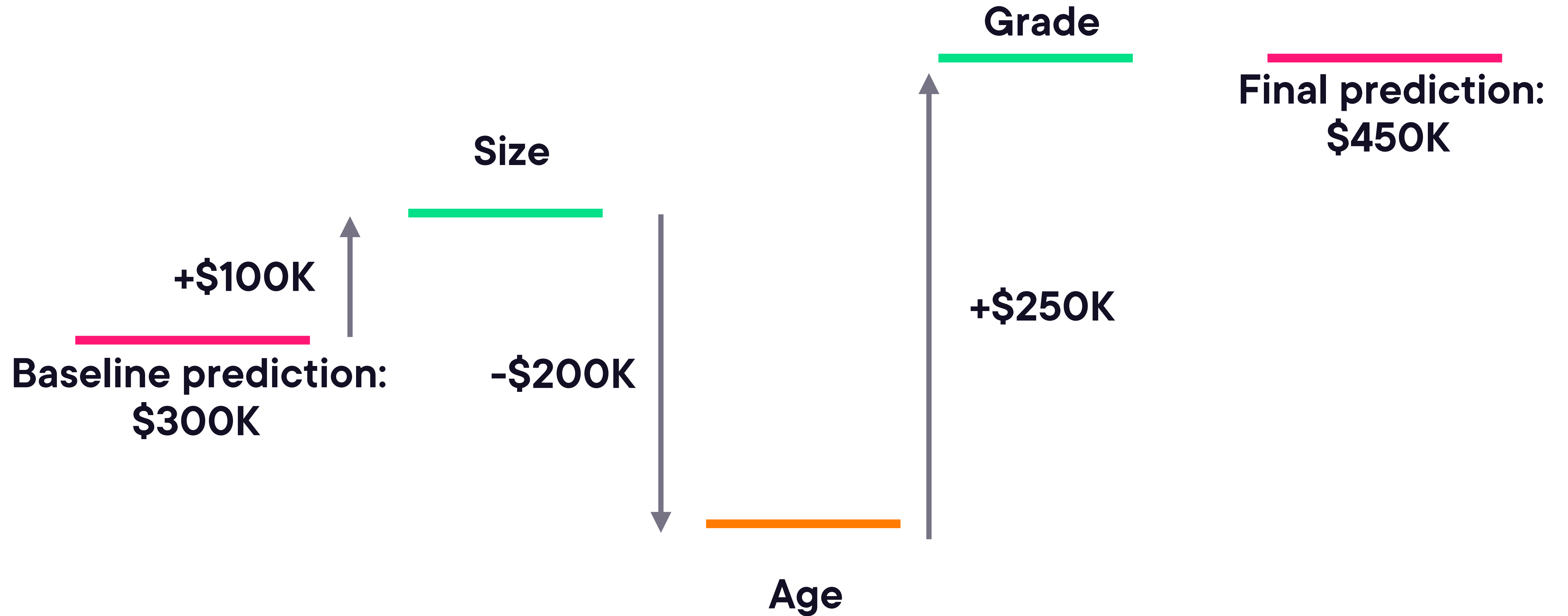
# Predicting Home Price: Computing SHAP Values



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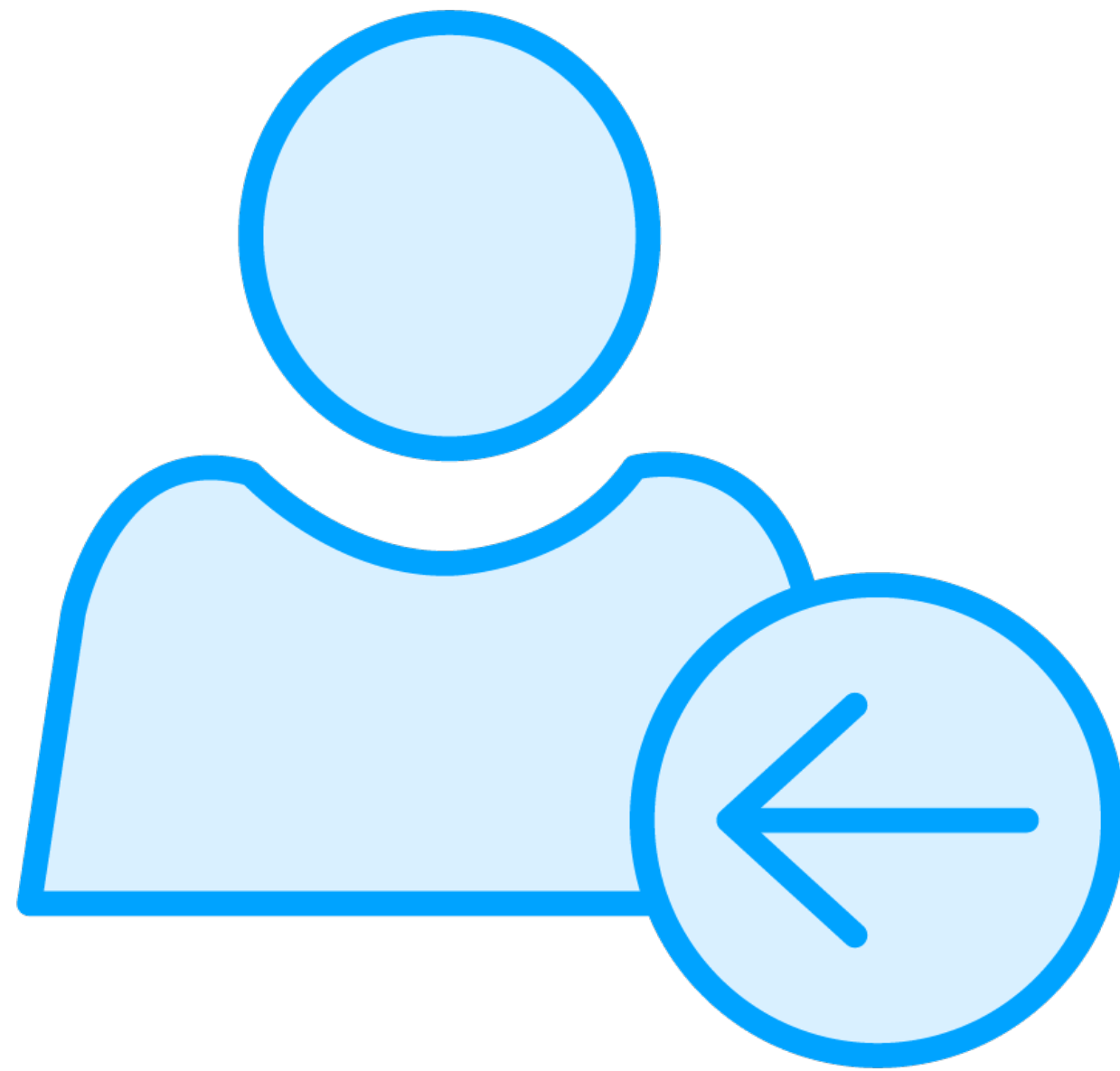


# Predicting Home Price: Computing SHAP Values





# What Do SHAP Values Take into Account?

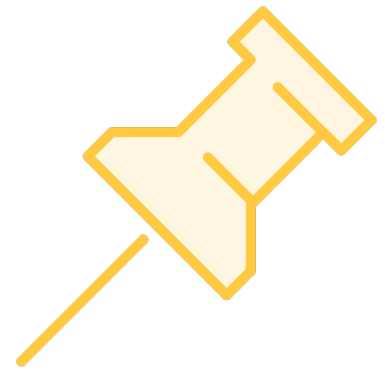


Impact of a feature across all possible combinations of other features

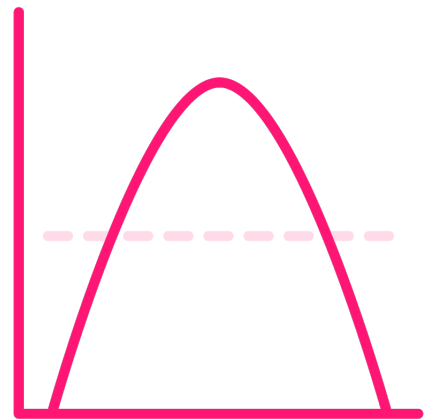
Feature interactions (combinations of features with non-linear results)



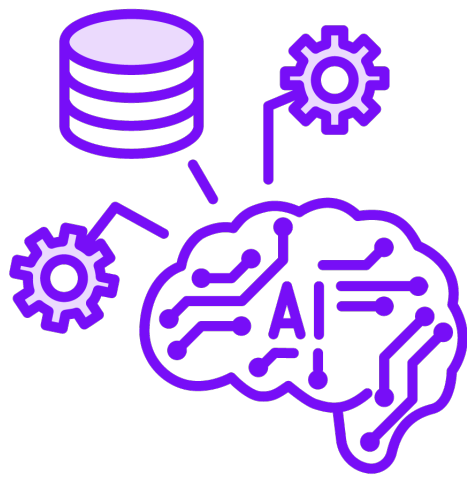
# SHAP Metrics



**SHAP Value (per feature, per prediction)**



**Mean Absolute SHAP Value (per feature)**



**SHAP Interaction Values**

