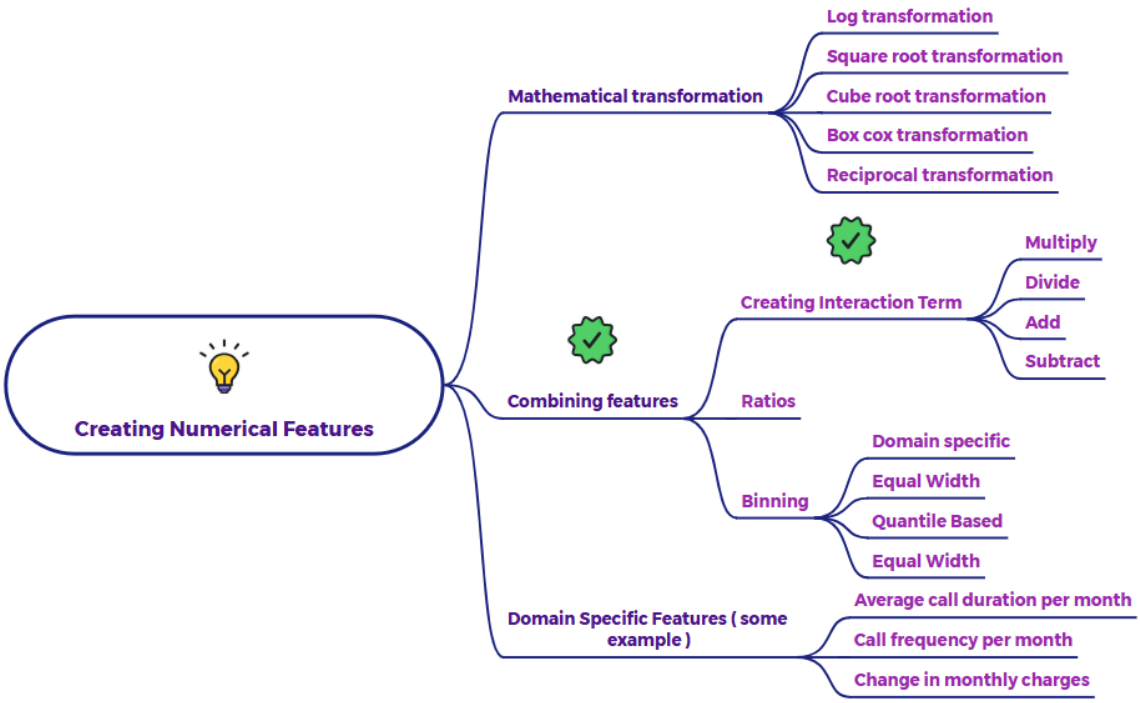
Explain Creation of Interaction term with an example



Understanding Interaction Terms

In machine learning and statistics, interaction terms are new features created by combining two or more existing features. They allow a model to capture relationships between variables that might not be apparent when considering each variable independently.

Example: Predicting Plant Growth

Suppose we want to predict the growth of plants. We have the following features:

- **Sunlight** (hours of sunlight per day)
- **Water** (ml of water per day)

1. Multiplication (Interaction Term: Sunlight x Water)

- We create a new feature Sunlight_Water_Interaction by multiplying Sunlight and Water.
- Sunlight_Water_Interaction = Sunlight * Water
- Interpretation: This term captures how the effect of sunlight on plant growth varies with the amount of water.

- For instance, more sunlight might generally increase growth, but this effect could be more pronounced when the plant also receives more water. A plant with a lot of sunlight but little water might not grow as much as a plant with both high sunlight and high water levels.

2. Division (Interaction Term: Sunlight / Water)

- We create a new feature Sunlight_Per_Water by dividing Sunlight by Water.
- Sunlight_Per_Water = Sunlight / Water
- Interpretation: This term represents the amount of sunlight per unit of water. It could indicate the efficiency with which a plant uses water in relation to the sunlight it receives.
    - A high value might suggest the plant thrives in sunny conditions even with less water, while a low value might indicate the plant needs a lot of water to make use of the sunlight.

3. Addition (Interaction Term: Sunlight + Water)

- We create a new feature Sunlight_Plus_Water by adding Sunlight and Water.
- Sunlight_Plus_Water = Sunlight + Water
- Interpretation: In this context, this term represents the total amount of resources (sunlight and water) available to the plant.
    - It might be useful if the total amount of resources is a limiting factor for growth.

4. Subtraction (Interaction Term: Sunlight - Water)

- We create a new feature Sunlight_Minus_Water by subtracting Water from Sunlight.
- Sunlight_Minus_Water = Sunlight - Water
- Interpretation: This term represents the difference between sunlight and water.
    - A positive value suggests the plant receives more sunlight than water, which might be beneficial for certain types of plants. A

negative value suggests the plant receives more water than sunlight, which might be beneficial for other types of plants.

Key Points

- The choice of which interaction terms to create depends on the specific problem and domain knowledge.
- Interaction terms can improve model accuracy but also increase complexity.
- Regularization techniques can help manage the complexity introduced by interaction terms.