

# limma result categories

limma analysis results can be divided into three categories, which are defined in this document.

1. **Time Effect:** This category focuses on the changes of the feature (e.g. protein) value that occur over time within a single condition.
2. **Average Difference Between Conditions:** This category compares the average feature values for levels within a condition, regardless of time.
3. **Interaction Between Condition and Time:** This category examines the interaction between time and condition. It identifies features whose value changes differently over time depending on the condition.

## Legend:

A hit is a feature (e.g. a protein) that is significantly changed over the time.

Levels are the different factors of a condition of the experiment. For example, bioreactor phase is a condition, and exponential and stationary are levels within that condition.

## Category 1 (time effect)

Temporal pattern within level for a given feature → Hit

Example for a hit

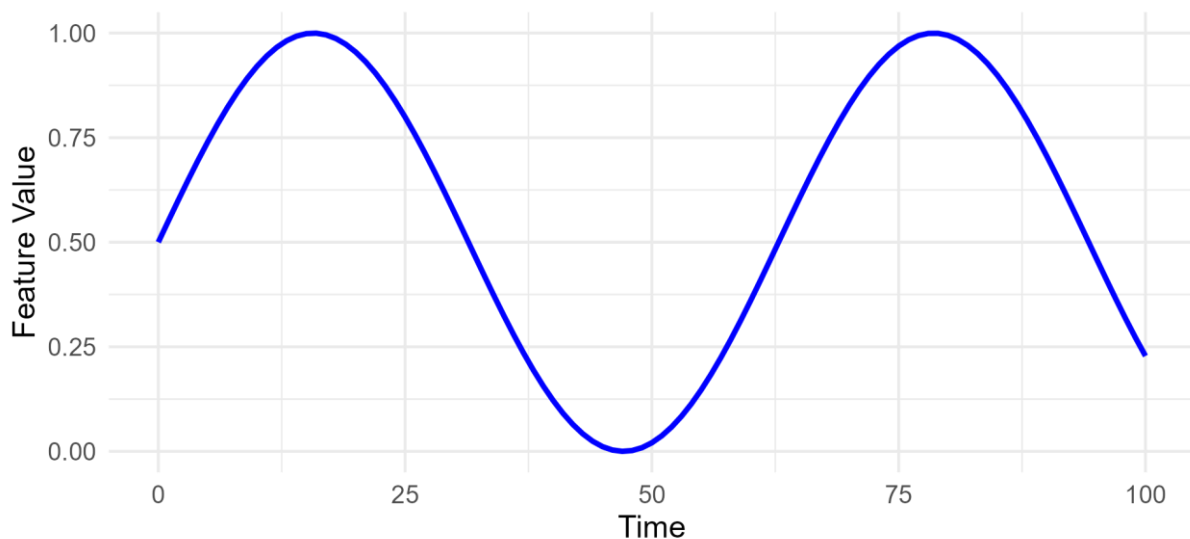


Figure 1: Clear temporal pattern → hit for category 1.

Example of a feature that is no hit

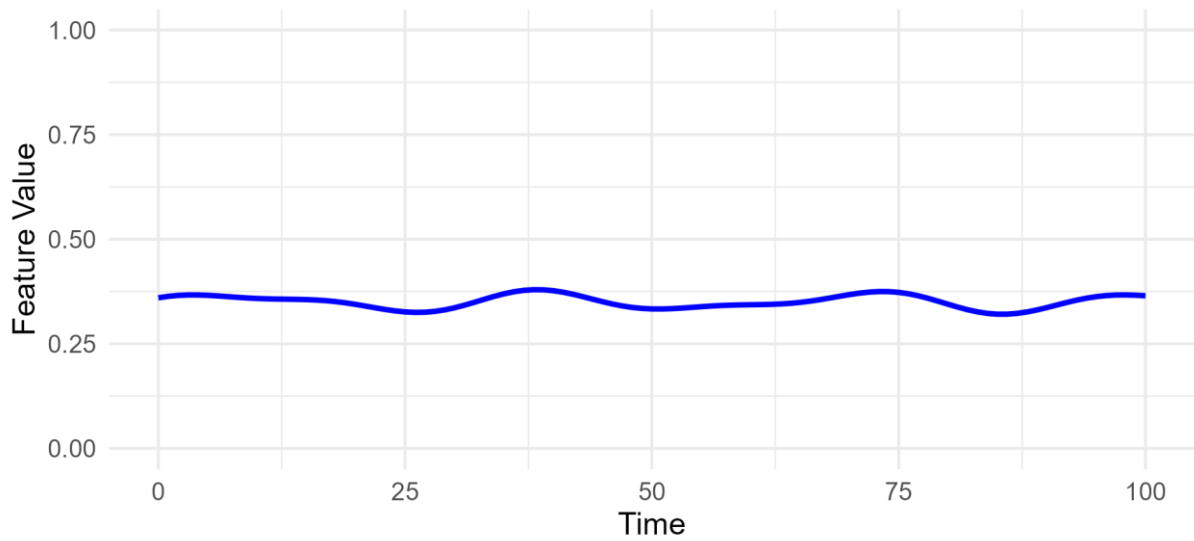


Figure 2: No clear temporal pattern → no hit for category 1.

### Category 2 (average difference conditions)

Overall mean difference between levels for a given feature → Hit

Example for a hit

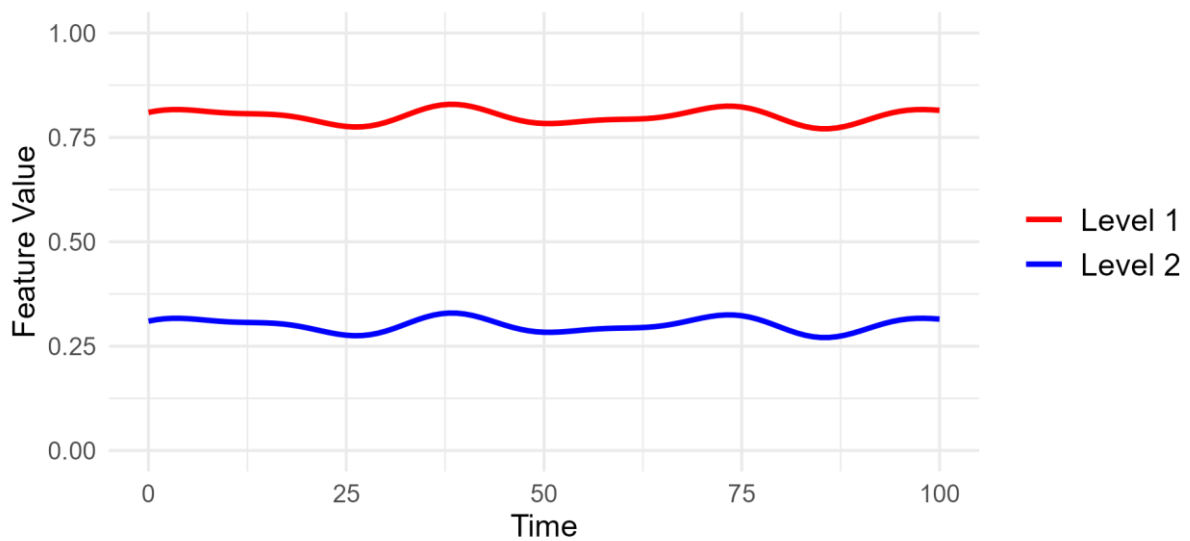


Figure 3: No clear temporal pattern for both levels but overall mean difference between them → hit for category 2.

Example for a feature which is no hit

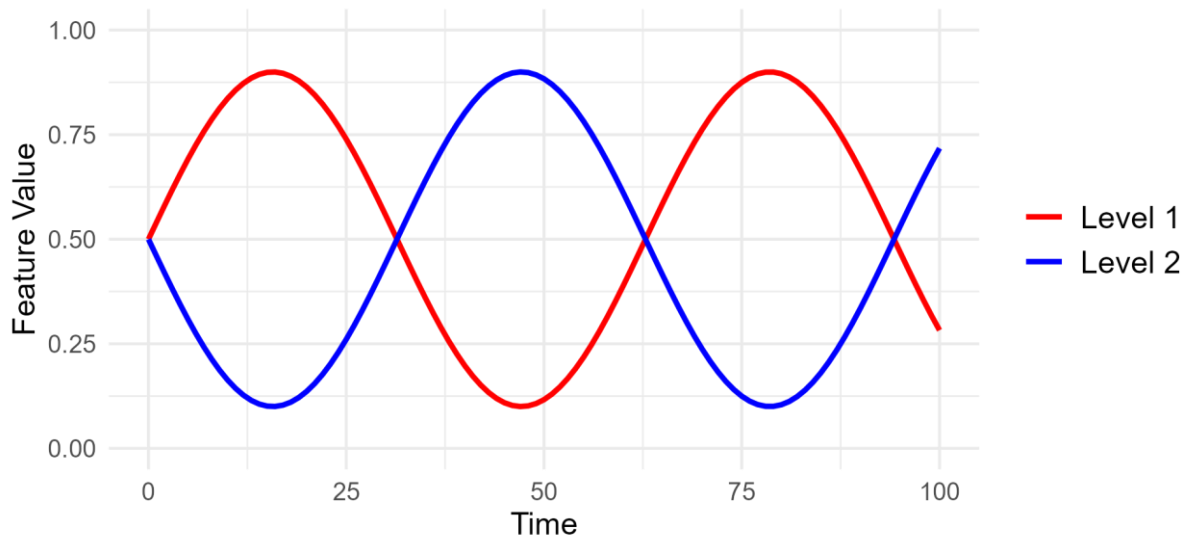


Figure 4: Clear temporal pattern for both levels but no overall mean difference in feature value between them → no hit for category 2.

### Category 3 (interaction condition & time)

Treatment interacting with time for a feature (time effect changing with treatment, the feature must have different temporal patterns in both conditions/levels) → Hit

Examples for hits

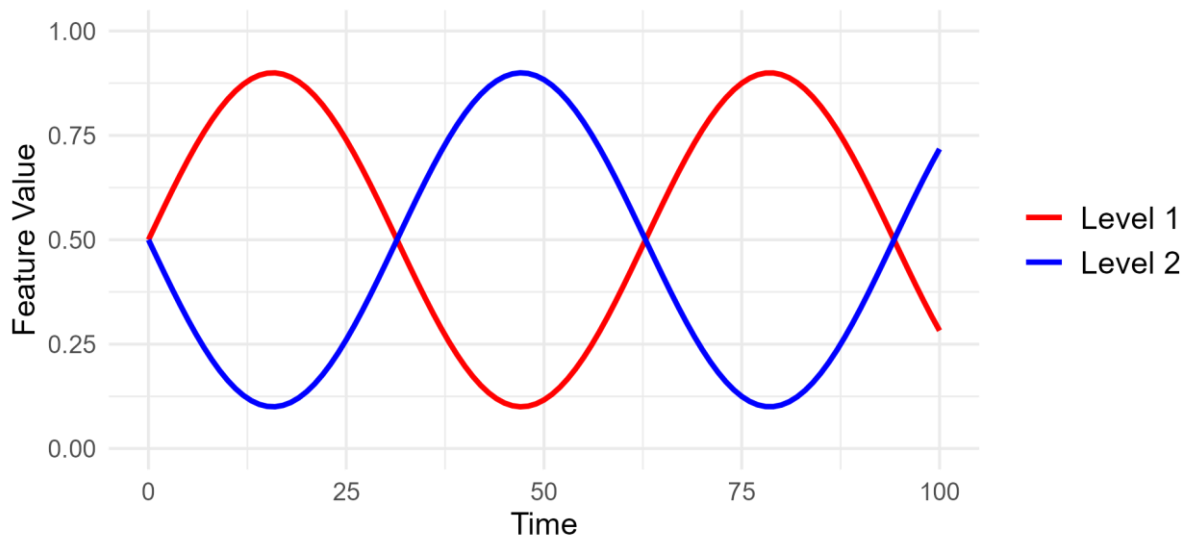


Figure 5: Different temporal patterns of the feature for both levels → hit in category 3.

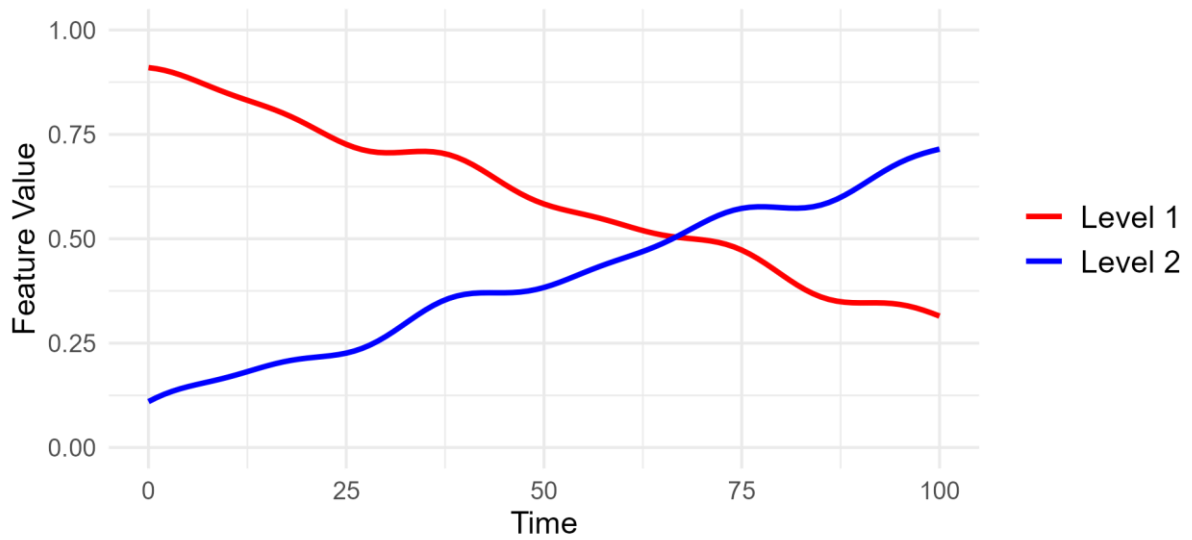


Figure 6: Different temporal patterns of the feature for both levels → hit in category 3.

Example of a features that is no hit

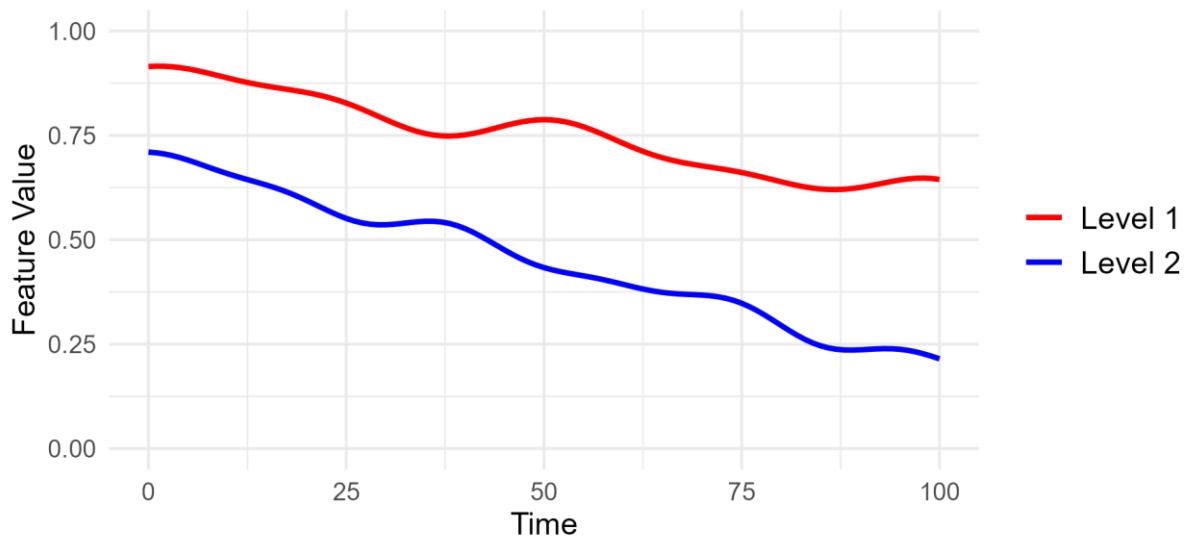


Figure 7: Overall the same temporal pattern of a feature for both levels → no hit for category 3.