

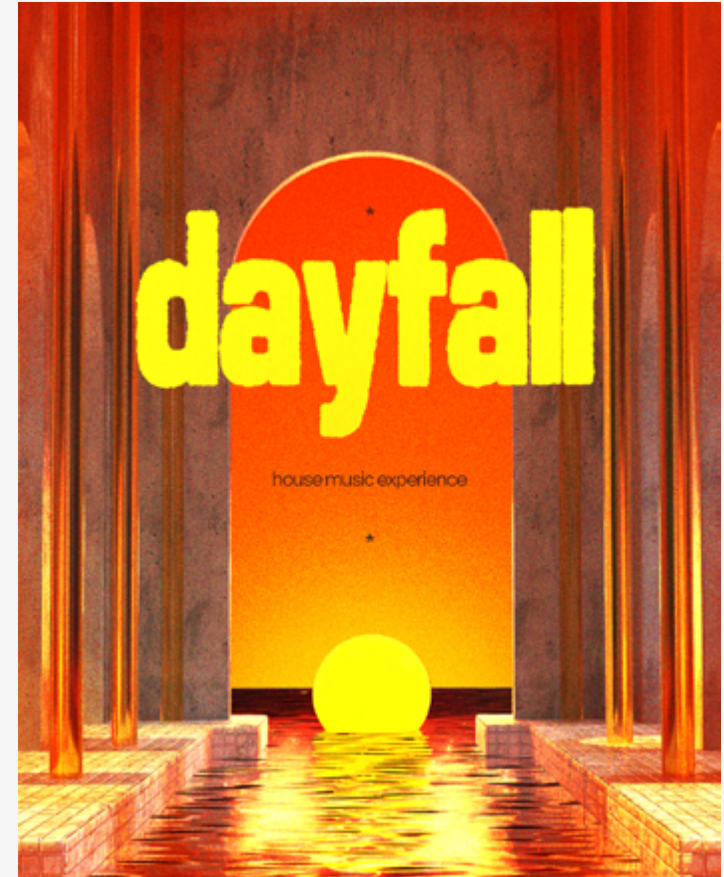


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Daniel Daringer

Daniel Daringer is a graphic designer, art director, and illustrator. Over several years, he has created work for agencies, hotels, brands, and his own clients, spanning branding, editorial, and campaigns while sharpening his illustrative style. He thinks conceptually and delivers on the craft, ideally both at once. For him, good design is never just decoration but a strategy with impact. Whatever he takes on, he does it with heart and the conviction that what ends up on the page should both stand out and hold up.

Dayfall — Exemplary Visuals



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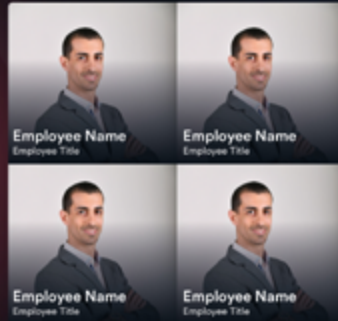


Messe Stuttgart (Germany)
June 4-6, 2024
9 BOOTH 1224



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Meet the team



Book a meeting with us using the link in the post!



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Section 01

Understanding Univariate Anomaly Detection

Univariate anomaly detection involves identifying unusual patterns or outliers in a single variable's data. This method analyzes one feature at a time to detect deviations from the expected behavior. Standard techniques include calculating the Z-score to measure how many standard deviations an observation is from the mean, applying moving averages to smooth out short-term fluctuations, and setting fixed thresholds to flag values that exceed normal operating ranges.

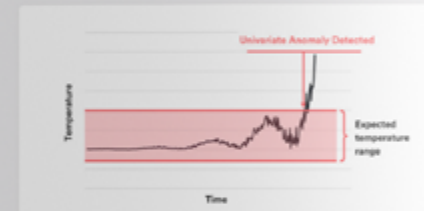


Figure 1: A temperature anomaly can be detected by setting an expected range as a simple univariate rule.

For example, monitoring the cell's temperature is crucial when testing a battery's behaviour. A sudden spike in temperature may indicate a malfunction or safety issue. Univariate methods are straightforward to implement and interpret, making them useful for real-time monitoring of specific parameters.

However, univariate techniques have limitations. They fail to detect anomalies that are only apparent when considering the relationships between multiple variables. For instance, in a cell cycling test, a slight increase in temperature might be expected unless it coincides with a voltage drop and a current rise, indicating a potential problem. This limitation underscores the need for multivariate anomaly detection, which analyzes multiple variables simultaneously to identify complex anomalies.

6



Section 01

Pros and Cons of Univariate Anomaly Detection



- **Simple Implementation**
Easy to set up using basic statistical techniques.
- **Easy Interpretation**
Results are straightforward and understandable.
- **Low Computational Cost**
Requires minimal processing power and resources.
- **Quick Processing**
Fast analysis suitable for real-time monitoring.
- **Minimal Data Needed**
Only needs data from a single variable.



- **Ignores Variable Relationships**
Does not consider how variables interact and assumes variables operate independently.
- **Prono to False Alarms**
May flag normal variations as anomalies.
- **Not Suitable for Complex Systems**
Ineffective for systems with interconnected variables.

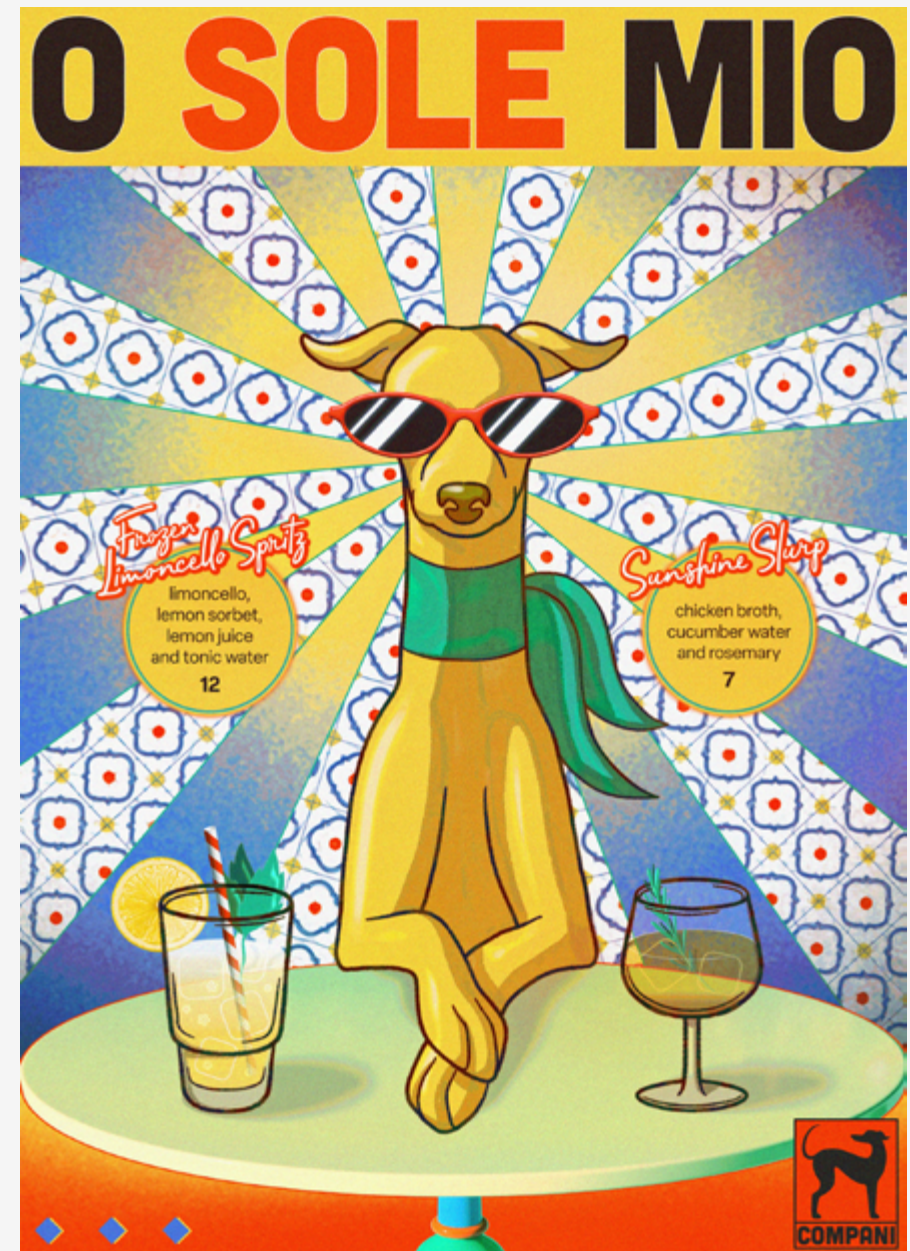
→ Going Further: Multivariate Anomaly Detection

Multivariate anomaly detection offers a more sophisticated approach by analyzing multiple variables simultaneously. This method captures the interdependencies and correlations between variables, enabling the detection of complex anomalies that univariate methods might overlook.

Multivariate approaches enhance detection accuracy and deeper insights into system behaviour by leveraging techniques such as Principal Component Analysis (PCA), Cluster Analysis, and Time-Series Auto-Encoders.



7



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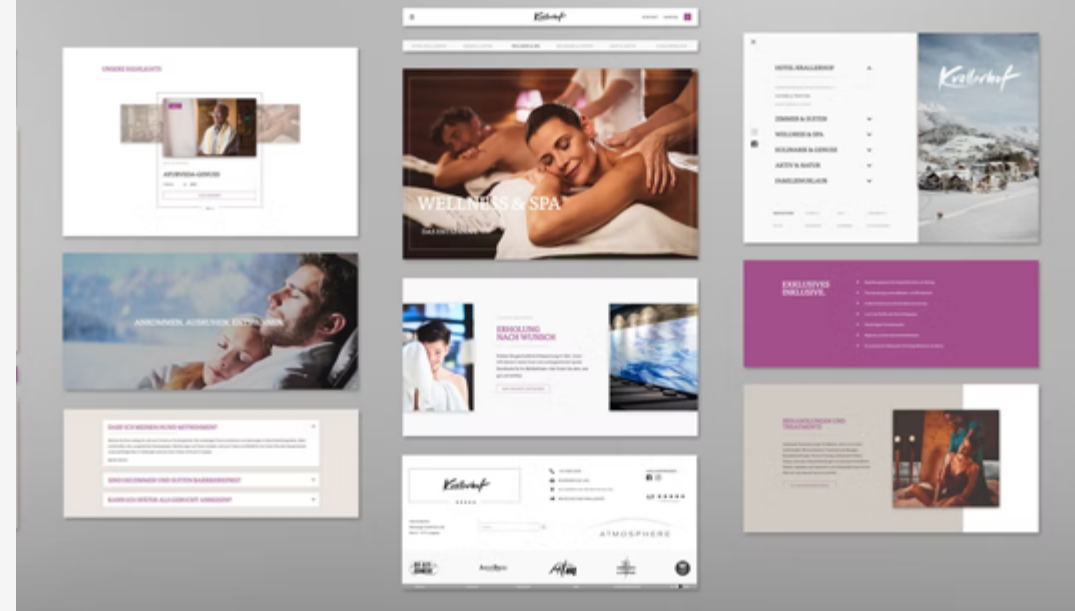
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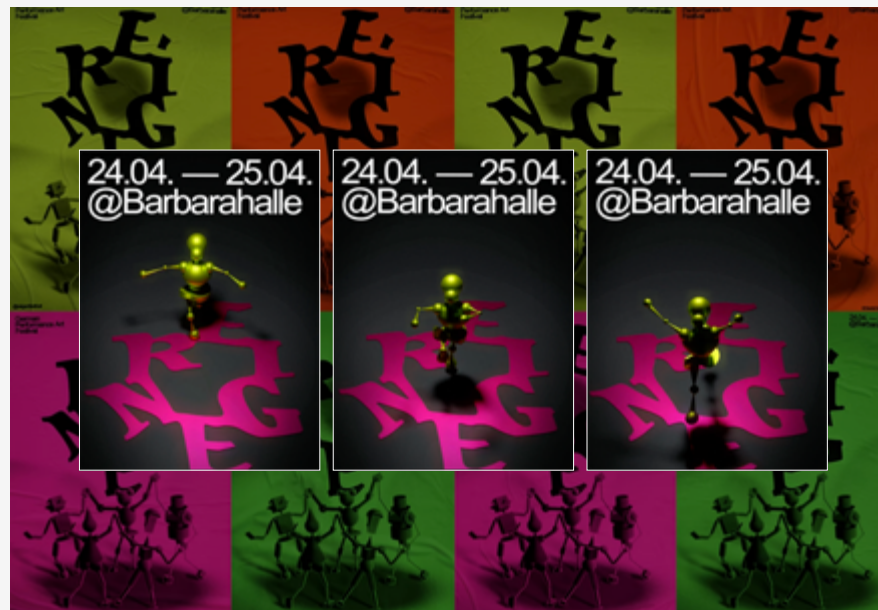
1.T.	45
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