

The background features several red geometric shapes, including triangles and polygons, in various shades of red. Some shapes are solid, while others are semi-transparent, creating a layered effect. A large, complex red polygon is on the left side, and a smaller one is on the right. The overall design is modern and tech-oriented.

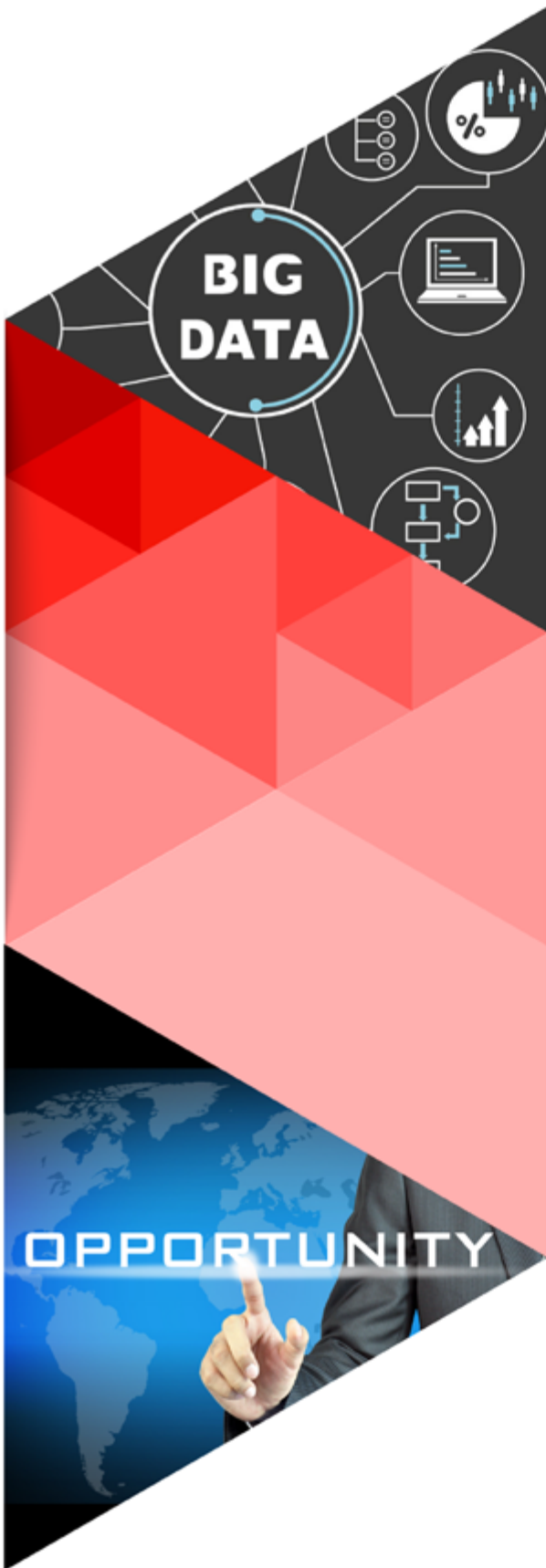
DO CBM DIFFERENTLY

DISCOVER, SCALE, DELIVER



TRENDALYZE

USA • United Kingdom • Bulgaria • India



Why Motif Discovery for CBM?

Set monitoring schedules based on first observation of patterns leading to failure.

Eliminate the collection and analysis of large samples of historical failures data.

No statistical modeling required.

Reduce dependence on data scientists/statisticians.

Anyone with domain expertise (engineers, analysts, clinicians & etc) can detect patterns, set up, and fine tune monitoring system - no special skills required.

Can be used immediately after software installation.

Easily customize monitoring for specific factors and environmental conditions.

Detect potential failures with high accuracy (Read our case study on our 97% accuracy in engine failure).

Contact: Lisa.Jung@trendalyze.com



Why is Condition Based Maintenance (CBM) Analytics and Monitoring So Difficult?

Condition Based Maintenance (CBM) can produce significant savings and yet many companies cannot realize the expected ROI using statistical approaches to analytics and monitoring.

Barrier #1: Unprecedented Volume and Variability of Data Complicates the Analysis

Large number of sensors collect data from machine parts operating under varying conditions. Each sensor generates huge volumes of data. The data contain motifs (i.e. recurring time-sequence patterns). Motifs tell the story of what varying factors and environmental conditions cause failure of an individual machine. Knowing and detecting motifs during operations provide tremendous value for industries that operate under dynamic conditions.

However, traditional statistical approaches cannot detect and monitor for motifs effectively. These approaches depend on thresholds derived from fitting a generalized approximation (mathematical model) on the historical data. Due to the high variability, the particular samples may be too small to fit a model. When this occurs, a model either cannot be generated or will be too general and yield false alarms. False alarms destroy the ROI on projects and can even lead to cost escalation as these can unnecessarily halt operations and distract workers from their jobs.


Solution: An innovative approach specifically designed for motif discovery is needed to understand and prevent individual machine failure.

Barrier #2: High Upfront Implementation and Continuous Management Costs

Statistical approaches require complex modeling that takes 8-12 months to build. This process requires a large sample of failures to train, test, and deliver the model. Furthermore, the accuracy of the models can often depend on costly data transformations to increase the model fit. Such transformations make it hard to operationalize and embed the model in production systems. Furthermore, industry depends on hard to find data scientists to create and tune these models on a regular basis, exerting more strain on industry operation budgets and increasing time to ROI.

In reality, most companies cannot afford to let machines fail to generate a large dataset necessary to train statistical models. Companies want to start monitoring based on manufacturer specifications or on the observation of potential failures made by employees. This heuristic approach allows companies to learn and prevent failures before they occur.

Solution: An intuitive, easy to use analytics and monitoring system for non - data scientists is needed for cost effective implementation and continuous management of CBM.





Unique Solution for Most Challenging Barriers of CBM

Trendalyze is a motif discovery platform offering simpler approaches and tools for CBM. It scales to millions of machines powered by IoT sensors and helps discern motifs as well as search for similar ones. As a result, our users can validate intuitive choices, find out and understand underlying causes, and quickly set up outcomes managing monitoring.

Trendalyze motif exploration visualizations enable operational workers to discern interesting facts at a glance. A single click turns those findings into real-time monitoring dashboards available on the web and on mobile devices, thus empowering professionals to make on-the-spot, data driven decisions that can improve outcomes.

Our unique approach called Motif Discovery facilitates every step of the way to improve every aspect of business operations.


Use Case:

Paul is a subject matter expert analyst who oversees condition based maintenance of manufacturing plants in New England/Mid Atlantic and Southeast region. Knowing that machine longevity is dependent upon various environmental factors, he has placed sensors to measure pressure, humidity, vibration, and temperature on each machine last month. Due to the starkly different and variable climates of New England/Mid Atlantic and Southeast regions, he realizes that combination of factors that causes machine failure can differ from machine to machine and environment to environment.

After extensive research, statistical modeling seems to be the main approach used by his peers. However, he sees the following pain points of this approach.

- 1) Applying statistical modeling derived from fitting a generalized approximation (mathematical model) on variable environments yield distracting false alarms.
- 2) Modeling requires large set of historical data of machine failures. Not only does he not have enough historical data large enough for statistical modeling due to recent adoption of sensors, his company cannot afford to let the machines fail so that the model could learn and predict failure.
- 3) Developing a model for monitoring and alert alone takes 8-12 months and this could only be done by highly trained and costly statisticians and data scientists. In addition the model has to be tuned all the time which adds to the maintenance costs.

While contemplating the pros and cons of statistical modeling, Paul hears about an alternative approach from Trendalyze. He tries the Trendalyze platform to determine whether it addresses the pain points of statistical modeling.



Implementation Steps:

Step 1: Paul opens the **Motif Explorer**, which allows him to access sensor data regarding machine performance, humidity, vibration, temperature, and other related factors. Through intuitive and easy to use UI, he visualizes various sensor data from a New England manufacturing plant, which allows him to find interesting motifs that may signal machine failure (i.e. what recurring patterns of humidity, temperature are seen with declining machine performance). Interested in whether these motifs are observed in different machines and different time points, he selects the motifs. In Google-like fashion, he searches for similar motifs across the entire database in seconds in order to determine if the motif is recurring. He selects and saves the observable humidity, temperature, and vibration motifs leading to declining machine performance.

Step 2: Paul then opens the **TrendTracker**, which allows him to use the saved motifs in step 1 to create real-time monitoring schedules. As a result, when selected motifs of humidity, temperature, vibration, and declining machine patterns are detected, it alerts the maintenance crew via alert app.

Step 3: In order to share his findings from New England plant's sensor data with manufacturing plants in other regions, he uses TrendTracker. His colleagues across departments and industries with Trendalyze products can now use his findings to explore motifs seen in their manufacturing plants to build customized monitoring applications in fraction of time.

All the the analysis, searching, monitoring, predicting and alerting is done by the **Trendalyze Server** behind the scenes.

Paul saw three benefits:

1) Using the Trendalyze platform, Paul was able to easily find motifs of multiple factors that contribute to machine failure. He was able to set up monitoring system customized for specific environments, significantly lowering false alarms (Read our case study on our 97% accuracy in engine failure).

2) This process did not require large historical data of failure as Paul was able to select motifs seen leading to a machine is failure, saving his company from collecting costly failure data so statistical modeling could learn and predict.

3) This process would have taken data scientist 8-12 months to set up. However, this process was completed by Paul in fraction of time, a subject matter analyst who had no statistical training.





Frequently Asked Q and A

1. What evidence do you have that Trendalyze motif-searching methodology is able to identify similarly-occurring failures?

This is easy to prove. Give us historical data on failures that have occurred over time. We can take the motif of the first failure and report the number of failures detected in the rest of the dataset as well as their probability. This historical analysis provides a solid test on capability and a way to estimate ROI.

2. Does the system have to see a failure at least once before being able to 'mark' the motif (i.e. do the machines have to break once in order for Trendalyze to identify all future failures of similar equipment)? If that is the case, isn't predictive analysis or the manufacturer's maintenance schedule a better fit for those who simply cannot afford to let a machine fail just to learn about its failure signature?

We created a motif discovery platform to solve this exact pain point. With our approach the system does not need to experience a failure before our users can detect and monitor for failure motifs. Our emphasis is on helping professionals to find motifs observed before failure and monitor for them. They can use manufacturing specs too or visually define expected motifs based on their experience in our tools. Our platform learns and predicts from trends leading to failure. This allows us to facilitate proactive CBM.

In contrast, statistical predictive analysis requires a large sample of failures to learn, train, and predict them,. It prevents domain experts from leveraging knowledge which can yield more accurate monitoring in environments with high variability. Maintenance schedule is costly and ineffective, which is why so many industries are switching to condition based maintenance.

3. How long does the technician have from recognizing the failure pattern to the failure actually occurring? Will I have enough time to remotely shut the machine down or get a maintenance crew on-site?

Because we monitor for sequences rather than a single threshold event, technicians will have a more accurate lead time prediction to take appropriate action before the failure occurs. The probability of failure increases as the motif starts to unveil. At the beginning, the probability is small, but as the motif advances the probability increases. Hence, users can specify notification threshold based on probability (70% likely to occur or 90% likely to occur). The longer the motif that leads to failure, the more lead time users have. Shorter patterns that occur in some real time systems, like fraud detection, may require decision automation to ensure swift action.

4. What type of training level is necessary for the users of the system?

Motif discovery is as easy as performing a Google search. Any domain experts (i.e. engineers, analysts, clinicians, etc) can use our tools to discover motifs, set and fine tune monitoring systems. They can also rapidly deploy monitoring dashboards and mobile apps to Android and iOS devices.

System administration would require very short training – in most cases 1-2 days. Setting up special operating environments may require up to 5 days. Special cases of data integration and data preparation may take 1-5 days. In 90% of the cases, this will not be needed but we acknowledge that there might be some very complex data preparation and integration cases.

5. What type of sensor data can you accept (both in format and sensor type)?

We accept data in JSON, XML, TXT [CSV,PSV, TSV] and other common formats. We also provide API for direct integration of sensor feeds and IoT broker middleware based on MQTT ISO standards. Supporting Mosquitto, Node RED and Azure IoT Hub. Interfaces include IoT devices, mobile apps, web APIs and log files. Sensor APIs support C#, C++, Java, Python and node.js. Mobile devices support Android and iOS.

Contact: Lisa.Jung@trendalyze.com

