



Use Case -
Process Variability & Correlation Analytics

Process Variability & Correlation Analysis

Tablet Coating Process - Fluid Bed Granulator

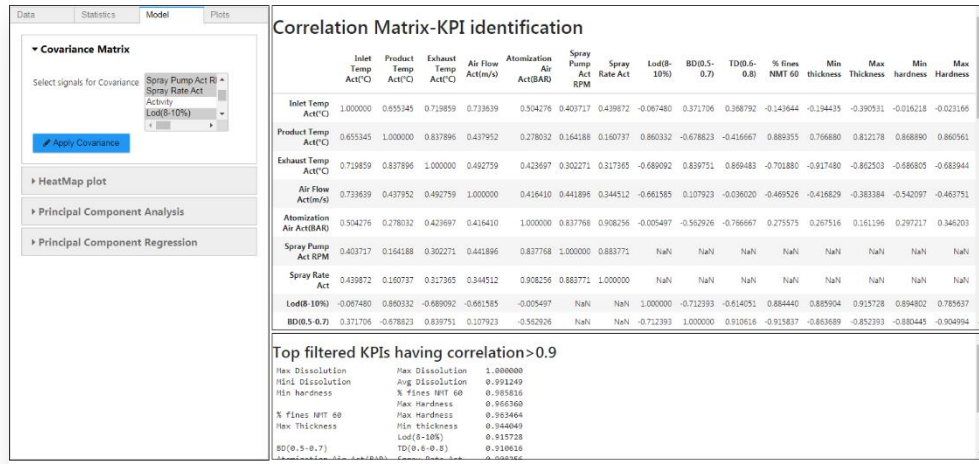
Problem Statement

- For the granulation process identify the critical KPIs that could possibly cause the deviation (variability) in the quality parameters of interest
- Score plot indicative of the deviation in the state of Granulation process
- Batch investigation and Root cause analysis for poor quality

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Advanced Models/Analytics

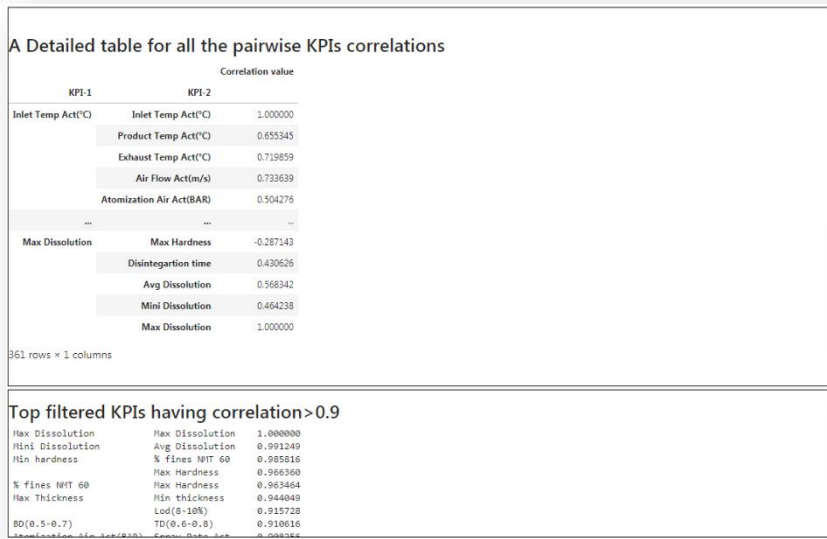


CORRELATION MATRIX

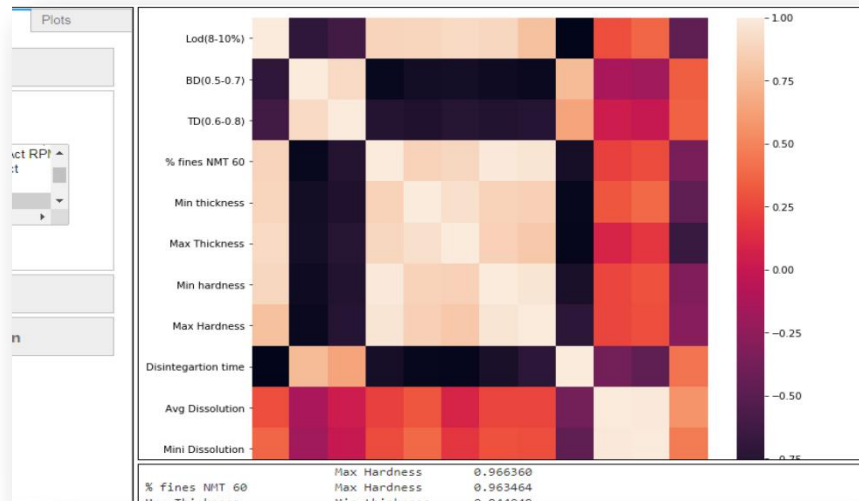
- To get the estimate of correlation of the KPI for granulation process, we selected the Temperature signals, flowrate, spray rate, atomization & all the quality parameters that were measured at the end of the batch operations.

Insights:

- A short descriptive dashboard filtering the insights about your top interactive parameters(KPIs and Quality) is determined.
- It was observed that the following quality parameters were highly correlated,
 - Min Dissolution—Avg Dissolution,
 - Min Hardness--% fines NMT 60,
 - Min Hardness—Max Hardness
- Also Product Temperature was highly correlated with LOD, % fines NMT 60, and hardness, and least correlated with TD and dissolution
- Inlet Temp was least correlated with almost every parameter, with a very low interaction on LOD and Hardness,
- Exhaust Temp was heavily correlated with all output parameters except dissolution,
- Similar kind of insights were extracted for flow rate and Atomization pressure.



Advanced Models/Analytics - Softanalytics



HEATMAP

- To get the estimate of correlation of the KPI for granulation process, we selected the Temperature signals, flowrate, spray rate, atomization & all the quality parameters that were measured at the end of the batch operations.

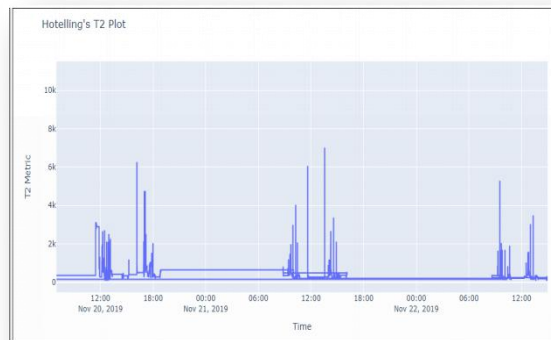
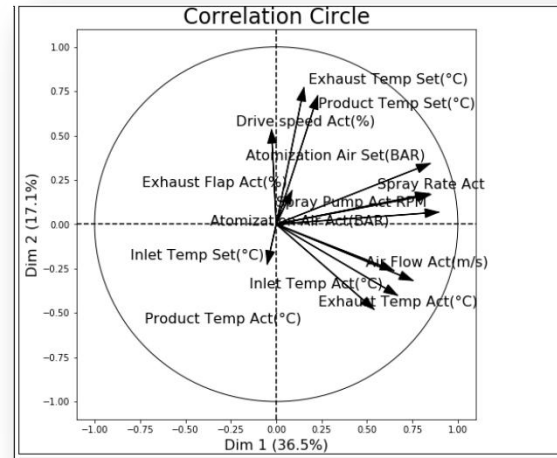
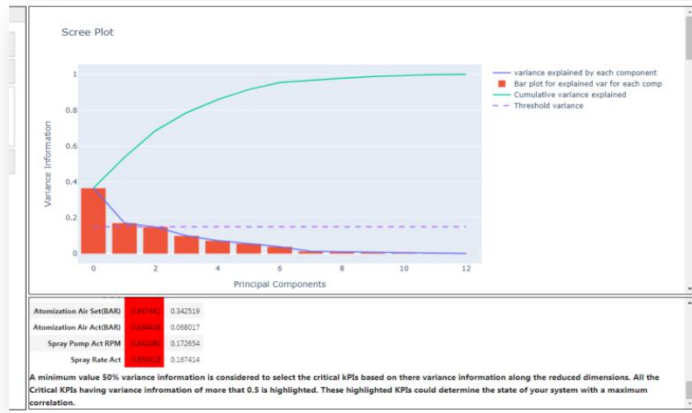
Insights:

- Heatmap view was used to understand the interaction or the correlation among your output quality parameters that were measured at the end of the each batch.
 - This analysis could help us to account for the the variability of the resulting quality parameters among themselves
- A second heatmap view was used to understand the interaction between the Actual KPIs in the Granulator, whether its perfectly, positive, or negative correlated, for estimating the state of the granulation process for batch performance estimation
 - One can easily exclude the KPIs that shows least interaction, which indicates that it doesn't contribute much to the variability of the system.

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Root Cause Analysis(PCA) - Softanalytics



PCA

Descriptive dashboard providing you a solutions with advance filtering of your critical KPIs and enabling the gateway of SPC for you, just on a single click.

- Dimension reduction,
- Principal components plot,
- Score Plots,
- T2 Plot

Insights:.

- Feature reduction from original Input space to new transformed space for Advanced model building using PCA.
- Filter the number of components to consider for PCA prediction
- Principal components indicates the associated variability of the input KPIs .
- Correlation plot is indicative of the interaction of KPIs in the transformed dimension.
- In Score plots the points with mahalnobis distance of more than a threshold from the cloud of points indicate the Anomalous behavior
- Hotelling's T2 plot indicate the point in time at which the unusual behavior in the state of system was observed.