

# Exploring Drowsiness Patterns in Wearable Device Data

Data Driven Insights into Indicating Drowsiness by the use of wearable technologies

By: Abel Metek





# AGENDA

1. Objective
2. Data Overview
3. Reports and Visualizations
4. Insights
5. Recommendations

# Objective

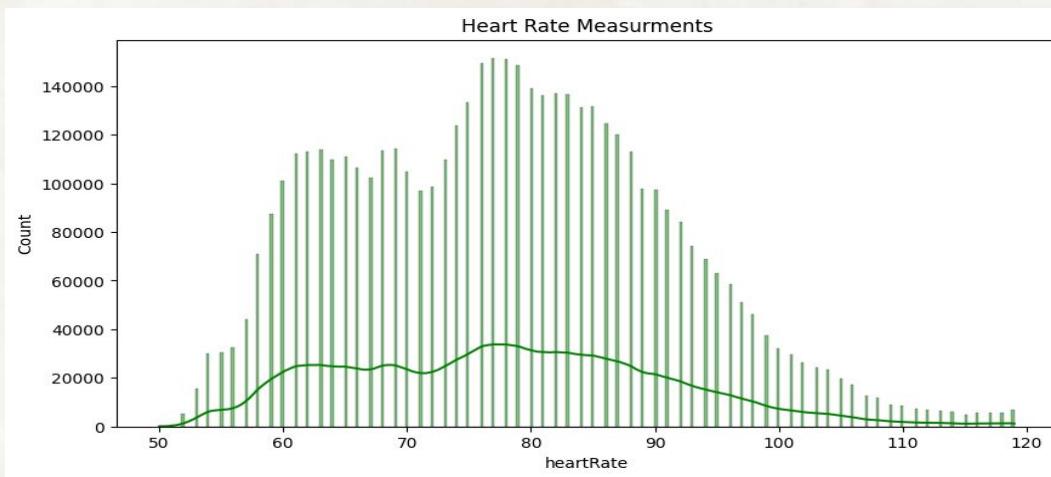
This analysis aims to understand drowsiness levels and patterns and how it relates to the smartwatches' measurement techniques like PPG green, red and IR and also how it relates to the heart Rate indicators. We aim to identify and see key insights about which measurement accurately represents the level of drowsiness so that we can develop more efficient smartwatches to alert individuals of potential drowsiness for their own safety and precaution.

# Data Overview

- Dataset: drowsiness\_dataset.csv
- Columns: Drowsiness, Heart Rate, PPG Green, PPG Red, & PPG IR
- Entries: 4890260 time stamped records

# Reports & Visualizations

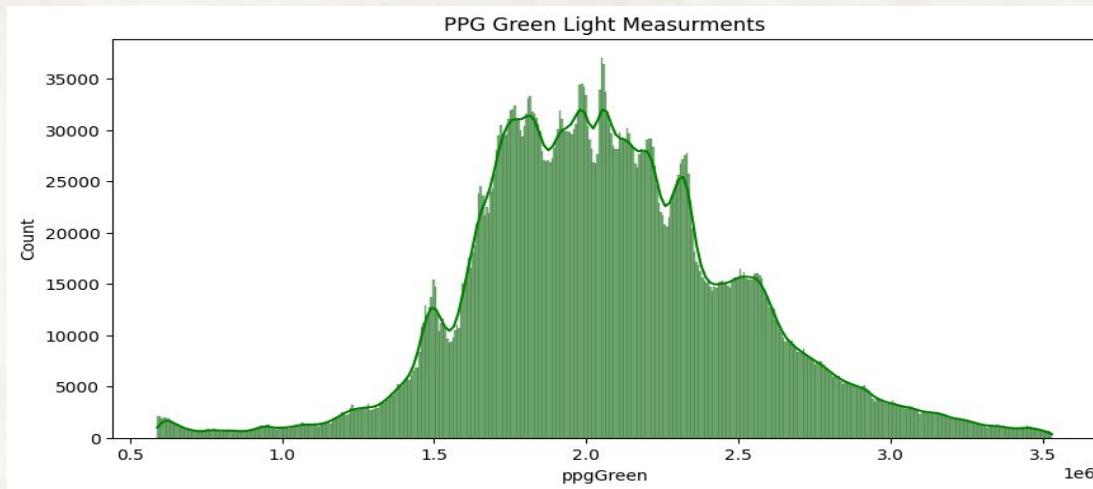
Distribution Visualizations: Bimodal Distribution



Key Insights: Heart Rate Measurements seem normally distributed with majority lying between 74-88 range

# Reports & Visualizations

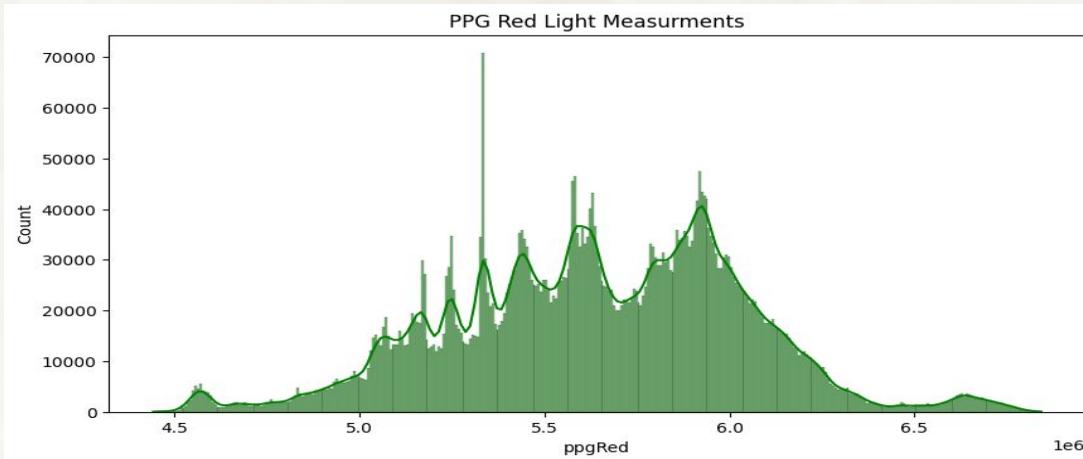
Distribution Visualizations: Normal Distribution



Key Insights: PPG Green Light Indicator Measurements also seems normally distributed with majority lying between  $1.7-2.3 \times 1e6$  range

# Reports & Visualizations

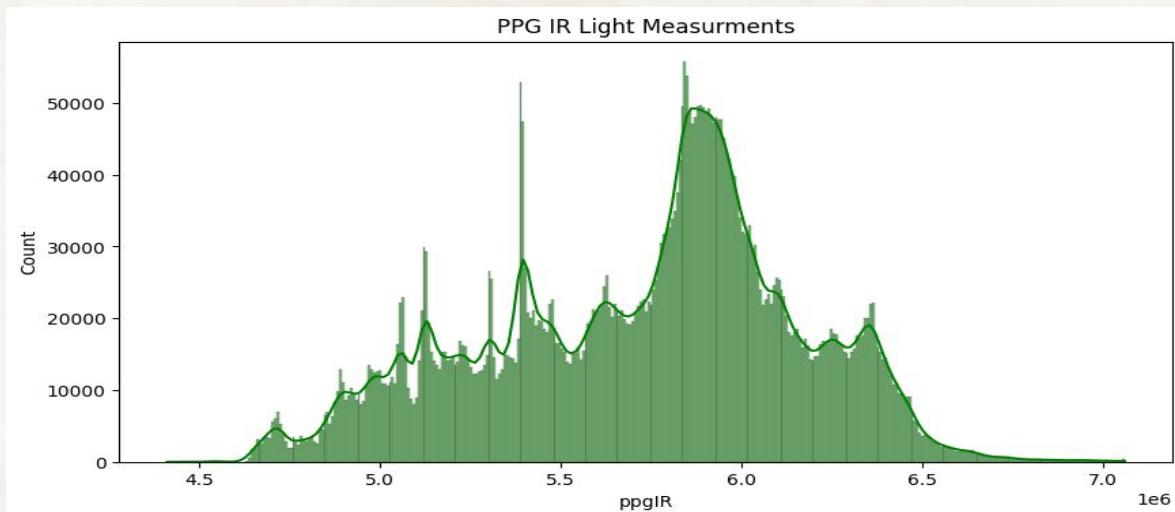
Distribution Visualizations: Multimodal distribution



Key Insights: PPG Red Light Indicator Measurements seems to have equal distributions or frequencies among different values with majority lying between 5.1-6.3\* 1e6 range, with few outliers

# Reports & Visualizations

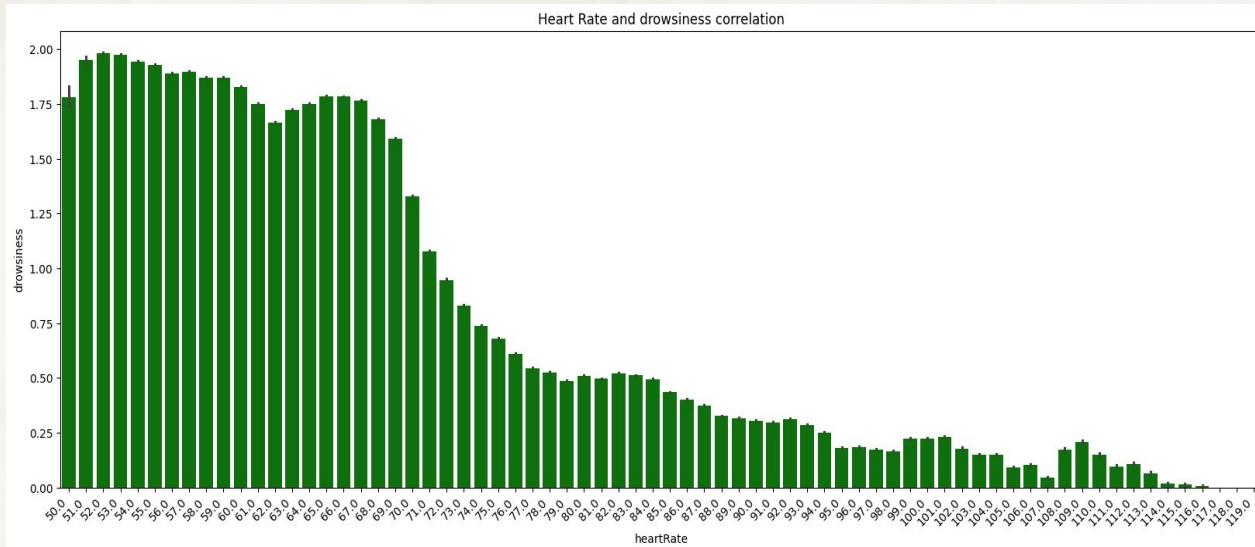
Distribution Visualizations: Multimodal distribution



Key Insights: PPG IR Light Indicator Measurements seems heavily distributed on the right with the majority lying between 5.7-6.1 \* 1e6 range

# Reports & Visualizations

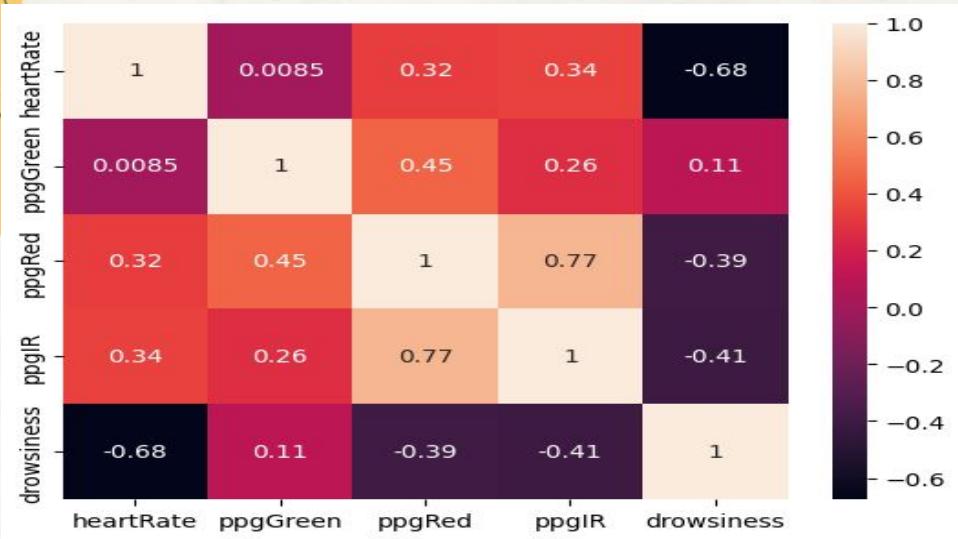
Correlation Visualizations:



Key Insights: Seems like the higher the heart rate the lower the drowsiness and the lower the heart rate the higher the drowsiness, indicating a negative relationship between drowsiness and heart rate.

# Reports & Visualizations

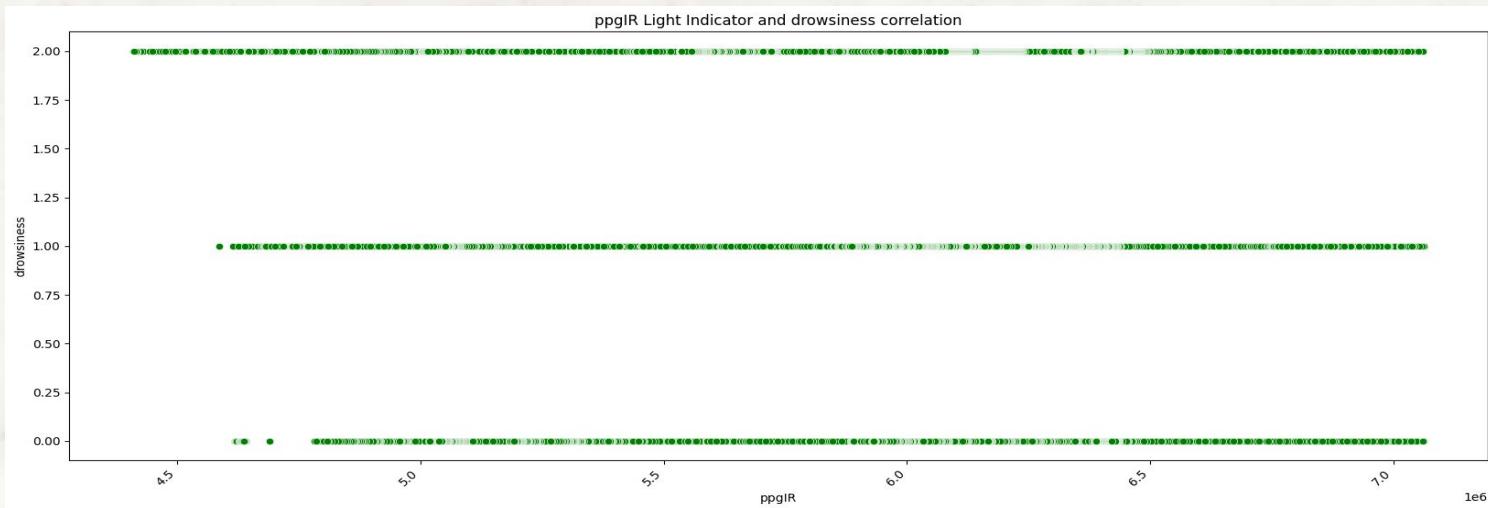
Correlation Visualizations:



Key Insights: The heatmap shows that there is quite strong negative correlation between drowsiness and heartRate and also some negative correlation between PPG IR and drowsiness as well as PPG Red and drowsiness, but not so much a correlation between PPG Green and drowsiness.

# Reports & Visualizations

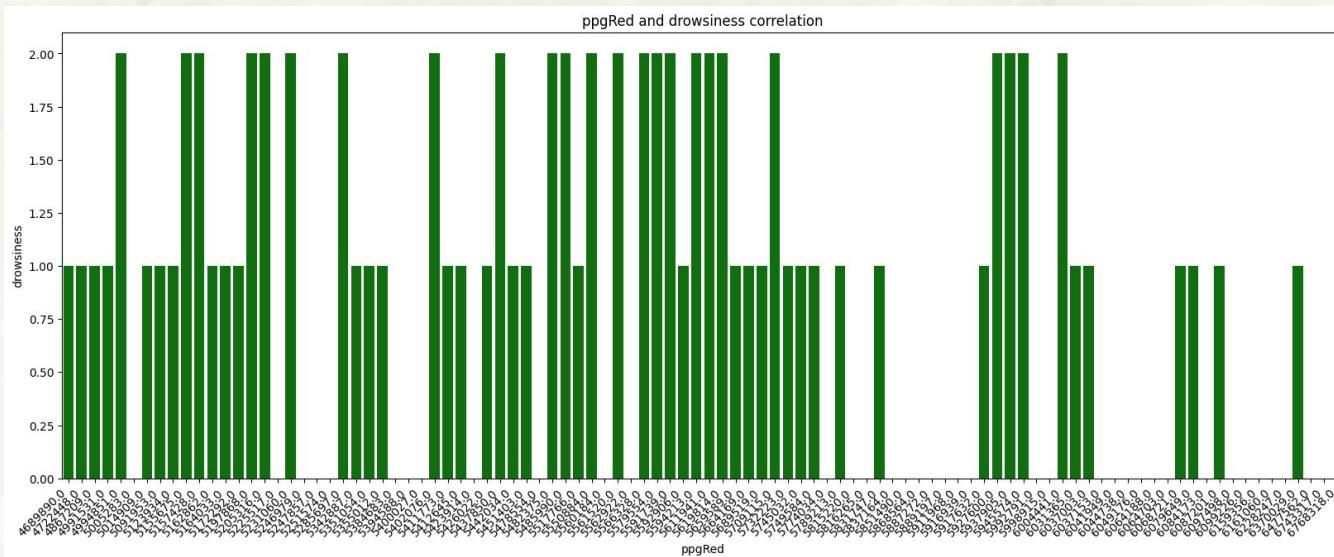
Correlation Visualizations: Further analysis on PPG's relationship with drowsiness



Key Insights: Scatter Plot shows that the lower the PPG IR the Higher Level of drowsiness based on the concentration of values, because lower levels of PPG IR are seen in higher drowsiness and higher levels with lower drowsiness but not strong correlation from this view

# Reports & Visualizations

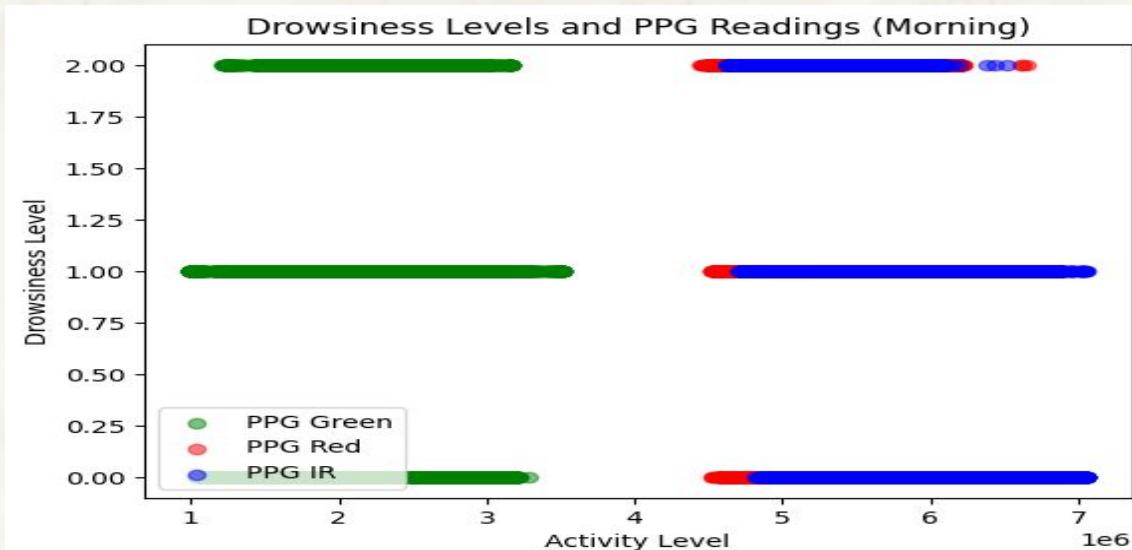
Correlation Visualizations: Further analysis on PPG's relationship with drowsiness



Key Insights: This barplot aims to show the relationship between PPG Red Light Indicator and Drowsiness levels, seems like not a strong relationship based on 100 random samples, but we do see lower levels of drowsiness as PPG Red gets higher but not significant relationship.

# Reports & Visualizations

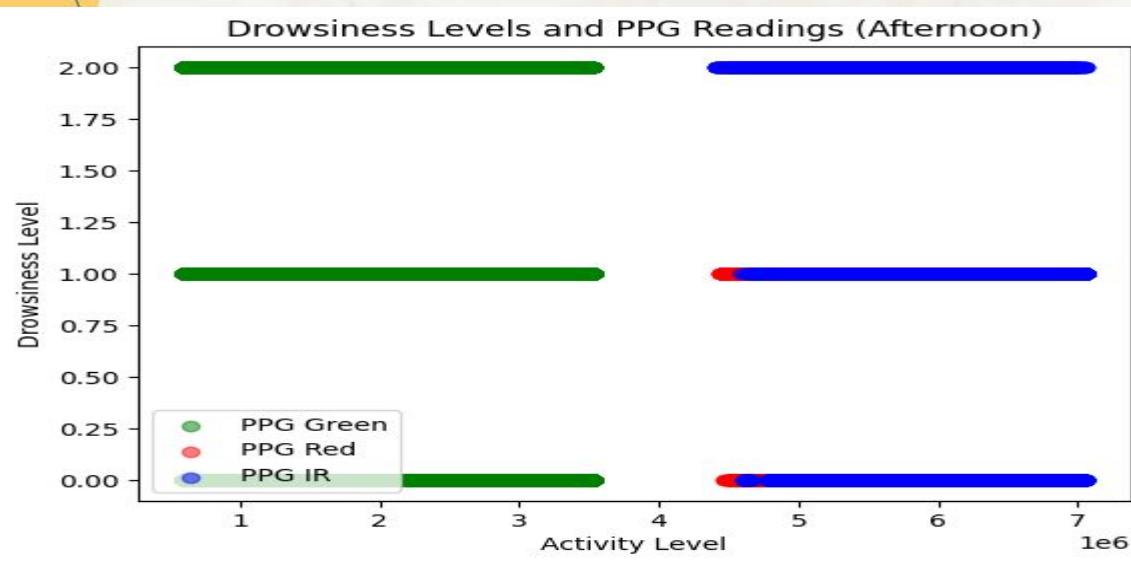
Correlation Visualizations: Further analysis on PPG's relationship with drowsiness based on period breakdown



Key Insights: This scatter plot shows that PPG IR has a bit of negative relationship with drowsiness as lower values of PPG IR showing higher levels of drowsiness but not a very clear relationship, same with PPG Red, but PPG Green seems to not have relationship with drowsiness much based on this plot as well.

# Reports & Visualizations

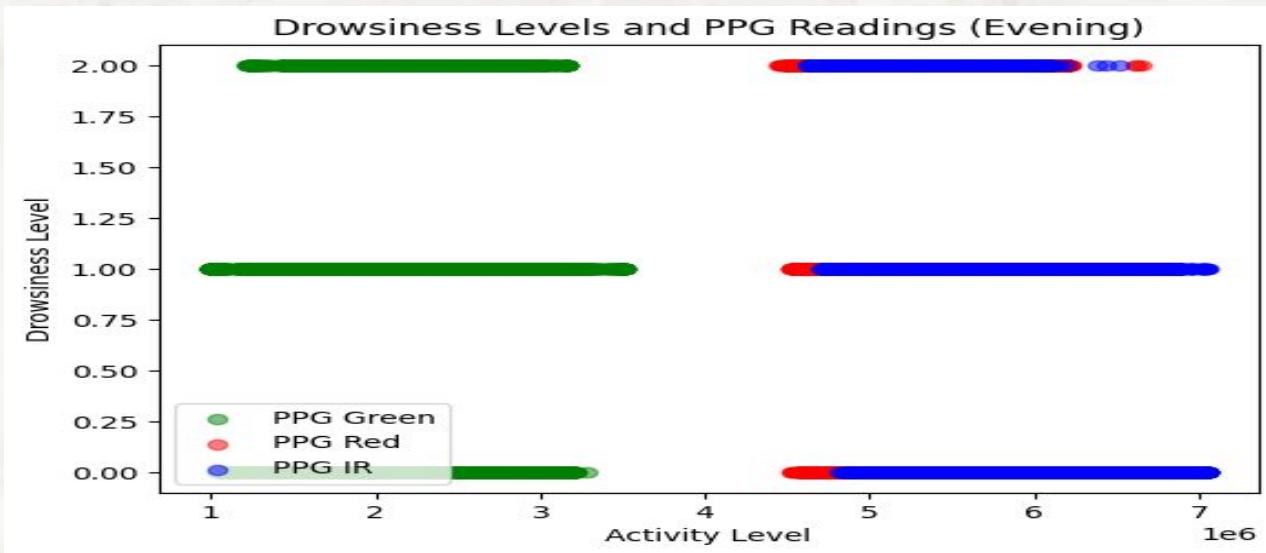
Correlation Visualizations: Further analysis on PPG's relationship with drowsiness based on period breakdown



Key Insights: This scatter plot shows that PPG IR has a bit of negative relationship with drowsiness as lower values of PPG IR showing higher levels of drowsiness but not a very clear relationship again and even smaller correlation compared to morning time, PPG Red doesn't seem to have any relationship with drowsiness at this time as well as PPG Green.

# Reports & Visualizations

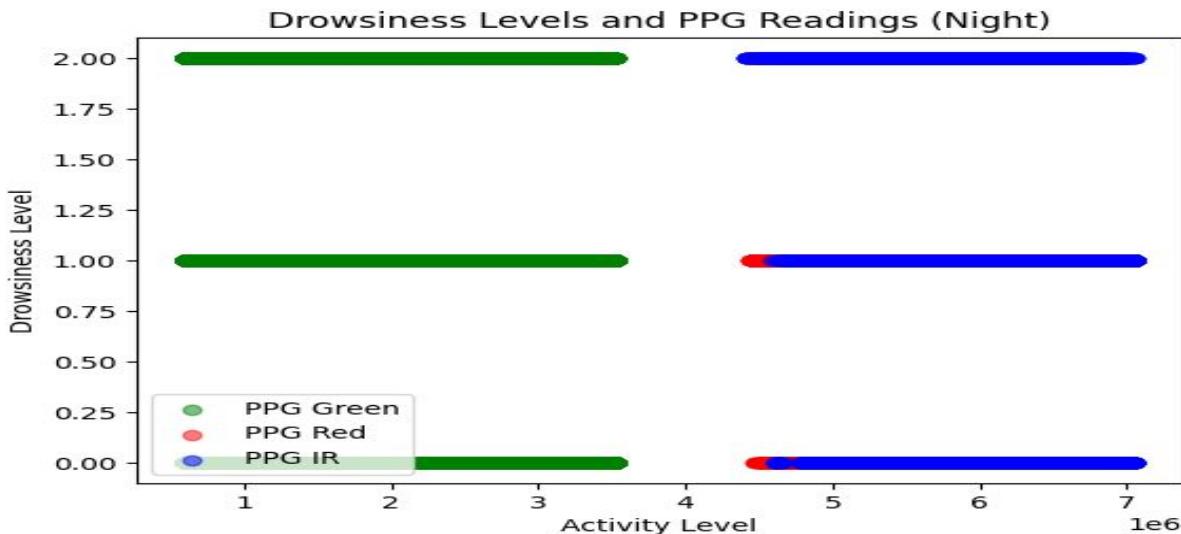
Correlation Visualizations: Further analysis on PPG's relationship with drowsiness based on period breakdown



**Key Insights:** This scatter plot shows that PPG IR has a bit of negative relationship with drowsiness as lower values of PPG IR showing higher levels of drowsiness but not a very clear relationship, same with PPG Red, but PPG Green seems to not have relationship with drowsiness, this time is similar to morning time results.

# Reports & Visualizations

Correlation Visualizations: Further analysis on PPG's relationship with drowsiness based on period breakdown



Key Insights: This scatter plot shows that PPG IR has a bit of negative relationship with drowsiness as lower values of PPG IR showing higher levels of drowsiness but not a very clear relationship again and this seems similar to the Afternoon time, PPG Red doesn't seem to have any relationship with drowsiness at this time as well as PPG Green.

# Recommendations & Further Research

Overall based on the insights seen through the visualizations presented, we can see a strong negative correlation between heart Rate levels and drowsiness which means the smartwatch can alert the user of potential drowsiness when their heart Rate is low but this doesn't imply causation. We also saw that perhaps PPG IR and Red have negative correlations with drowsiness levels meaning the smartwatches IR and Red light indicators can perhaps indicate levels of drowsiness helping warn the user, there is little evidence for this despite the correlation seen and further research would be suggested to make a more confident conclusions.