**Data Collection and Preprocessing Phase**

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| Date | 15 March 2024 |
| Team ID | Team-739686 |
| Project Title | Optimizing Sleep Efficiency: Harnessing Machine Learning For Enhanced Restorative Rest |
| Maximum Marks | 6 Marks |

**Data Exploration and Preprocessing Template**

Identifies data sources, assesses quality issues like missing values and duplicates, and implements resolution plans to ensure accurate and reliable analysis.

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| **Section** | **Description** |
| Data Overview | Basic statistics, dimensions, and structure of the data.  <class 'pandas.core.frame.DataFrame'>  RangeIndex: 452 entries, 0 to 451  Data columns (total 15 columns):  # Column Non-Null Count Dtype  --- ------ -------------- -----  0 ID 452 non-null int64  1 Age 452 non-null int64  2 Gender 452 non-null object  3 Bedtime 452 non-null object  4 Wakeup time 452 non-null object  5 Sleep duration 452 non-null float64  6 Sleep efficiency 452 non-null float64  7 REM sleep percentage 452 non-null int64  8 Deep sleep percentage 452 non-null int64  9 Light sleep percentage 452 non-null int64  10 Awakenings 432 non-null float64  11 Caffeine consumption 427 non-null float64  12 Alcohol consumption 438 non-null float64  13 Smoking status 452 non-null object  14 Exercise frequency 446 non-null float64  dtypes: float64(6), int64(5), object(4)  memory usage: 53.1+ KB |
| Univariate Analysis | Exploration of individual variables (mean, median, mode, etc.).  ID Age Sleep duration Sleep efficiency REM sleep percentage Deep sleep percentage Light sleep percentage Awakenings Caffeine consumption Alcohol consumption Exercise frequency  count 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000  mean 226.500000 40.285398 7.465708 0.788916 22.615044 52.823009 24.561947 1.641204 23.653396 1.173516 1.791480  std 130.625419 13.172250 0.866625 0.135237 3.525963 15.654235 15.313665 1.326338 29.353745 1.596013 1.418603  min 1.000000 9.000000 5.000000 0.500000 15.000000 18.000000 7.000000 0.000000 0.000000 0.000000 0.000000  25% 113.750000 29.000000 7.000000 0.697500 20.000000 48.250000 15.000000 1.000000 0.000000 0.000000 0.000000  50% 226.500000 40.000000 7.500000 0.820000 22.000000 58.000000 18.000000 1.000000 23.653396 0.000000 2.000000  75% 339.250000 52.000000 8.000000 0.900000 25.000000 63.000000 32.500000 3.000000 50.000000 2.000000 3.000000  max 452.000000 69.000000 10.000000 0.990000 30.000000 75.000000 63.000000 4.000000 200.000000 5.000000 5.000000ID Age Sleep duration Sleep efficiency REM sleep percentage Deep sleep percentage Light sleep percentage Awakenings Caffeine consumption Alcohol consumption Exercise frequency  count 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000 452.000000  mean 226.500000 40.285398 7.465708 0.788916 22.615044 52.823009 24.561947 1.641204 23.653396 1.173516 1.791480  std 130.625419 13.172250 0.866625 0.135237 3.525963 15.654235 15.313665 1.326338 29.353745 1.596013 1.418603  min 1.000000 9.000000 5.000000 0.500000 15.000000 18.000000 7.000000 0.000000 0.000000 0.000000 0.000000  25% 113.750000 29.000000 7.000000 0.697500 20.000000 48.250000 15.000000 1.000000 0.000000 0.000000 0.000000  50% 226.500000 40.000000 7.500000 0.820000 22.000000 58.000000 18.000000 1.000000 23.653396 0.000000 2.000000  75% 339.250000 52.000000 8.000000 0.900000 25.000000 63.000000 32.500000 3.000000 50.000000 2.000000 3.000000  max 452.000000 69.000000 10.000000 0.990000 30.000000 75.000000 63.000000 4.000000 200.000000 5.000000 5.000000   |  |  |  |  |  | **Output\_Energy** | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  | 4447.000000 | 4447.000000 | |  |  |  |  |  | 1019.491652 | 1176.785881 | |  |  |  |  |  | 5.154328 | 1374.223232 | |  |  |  |  |  | 1004.541667 | -1.077131 | |  |  |  |  |  | 1015.875000 | 0.000000 | |  |  |  |  |  | 1020.833333 | 482.019714 | |  |  |  |  |  | 1023.458333 | 2289.062988 | |  |  |  |  |  | 1028.208333 | 3602.782959 | |
| Bivariate Analysis | Relationships between two variables (correlation, scatter plots).   | **ID** | **Age** | **Gender** | **Bedtime** | **Wakeup time** | **Sleep duration** | **Sleep efficiency** | **REM sleep percentage** | **Deep sleep percentage** | **Light sleep percentage** | **Awakenings** | **Caffeine consumption** | **Alcohol consumption** | **Smoking status** | **Exercise frequency** | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **ID** | 1.000000 | 0.021310 | -0.013124 | -0.059307 | -0.058310 | 0.014736 | -0.025624 | 0.051636 | -0.047507 | 0.037160 | -0.055429 | -0.040342 | 0.113164 | 0.010804 | 0.024416 | | **Age** | 0.021310 | 1.000000 | 0.244468 | -0.024805 | -0.025337 | -0.065455 | 0.098357 | 0.042091 | 0.025800 | -0.031354 | -0.017468 | -0.180135 | 0.046474 | 0.031237 | 0.071892 | | **Gender** | -0.013124 | 0.244468 | 1.000000 | -0.062276 | -0.062457 | -0.046941 | 0.010062 | -0.161102 | 0.082634 | -0.039541 | 0.074205 | -0.299386 | 0.058287 | 0.143020 | 0.230169 | | **Bedtime** | -0.059307 | -0.024805 | -0.062276 | 1.000000 | 0.999929 | 0.038189 | -0.009028 | 0.038519 | -0.049915 | 0.034731 | -0.012240 | 0.069783 | -0.040375 | 0.017204 | -0.071991 | | **Wakeup time** | -0.058310 | -0.025337 | -0.062457 | 0.999929 | 1.000000 | 0.040773 | -0.009607 | 0.037928 | -0.050076 | 0.034976 | -0.011645 | 0.069779 | -0.040204 | 0.017658 | -0.073468 | | **Sleep duration** | 0.014736 | -0.065455 | -0.046941 | 0.038189 | 0.040773 | 1.000000 | -0.025352 | -0.018780 | -0.035441 | 0.037799 | 0.003434 | -0.017130 | -0.051693 | 0.007307 | -0.070873 | | **Sleep efficiency** | -0.025624 | 0.098357 | 0.010062 | -0.009028 | -0.009607 | -0.025352 | 1.000000 | 0.062362 | 0.788332 | -0.819075 | -0.554498 | 0.053539 | -0.383671 | -0.290026 | 0.257974 | | **REM sleep percentage** | 0.051636 | 0.042091 | -0.161102 | 0.038519 | 0.037928 | -0.018780 | 0.062362 | 1.000000 | -0.198674 | -0.015556 | -0.024992 | 0.073566 | -0.051709 | 0.032184 | 0.031165 | | **Deep sleep percentage** | -0.047507 | 0.025800 | 0.082634 | -0.049915 | -0.050076 | -0.035441 | 0.788332 | -0.198674 | 1.000000 | -0.974266 | -0.298433 | -0.013825 | -0.357714 | -0.226446 | 0.182975 | | **Light sleep percentage** | 0.037160 | -0.031354 | -0.039541 | 0.034731 | 0.034976 | 0.037799 | -0.819075 | -0.015556 | -0.974266 | 1.000000 | 0.313352 | -0.005775 | 0.374904 | 0.223500 | -0.191706 | | **Awakenings** | -0.055429 | -0.017468 | 0.074205 | -0.012240 | -0.011645 | 0.003434 | -0.554498 | -0.024992 | -0.298433 | 0.313352 | 1.000000 | -0.099927 | 0.198491 | -0.020781 | -0.212485 | | **Caffeine consumption** | -0.040342 | -0.180135 | -0.299386 | 0.069783 | 0.069779 | -0.017130 | 0.053539 | 0.073566 | -0.013825 | -0.005775 | -0.099927 | 1.000000 | -0.113368 | 0.026496 | -0.084257 | | **Alcohol consumption** | 0.113164 | 0.046474 | 0.058287 | -0.040375 | -0.040204 | -0.051693 | -0.383671 | -0.051709 | -0.357714 | 0.374904 | 0.198491 | -0.113368 | 1.000000 | 0.073629 | 0.006800 | | **Smoking status** | 0.010804 | 0.031237 | 0.143020 | 0.017204 | 0.017658 | 0.007307 | -0.290026 | 0.032184 | -0.226446 | 0.223500 | -0.020781 | 0.026496 | 0.073629 | 1.000000 | -0.040535 | | **Exercise frequency** | 0.024416 | 0.071892 | 0.230169 | -0.071991 | -0.073468 | -0.070873 | 0.257974 | 0.031165 | 0.182975 | -0.191706 | -0.212485 | -0.084257 | 0.006800 | -0.040535 | 1.000000 |  |  |  |  |  |  | **Output\_Energy** | | --- | --- | --- | --- | --- | --- | |  |  |  |  |  | -0.234967 | 0.882457 | |  |  |  |  | - | -0.020962 | 0.122913 | |  |  |  |  |  | -0.597324 | 0.403382 | |  |  |  |  |  | -0.129295 | -0.251067 | |  |  |  |  |  | 1.000000 | -0.249726 | |  |  |  |  | 7 | -0.249726 | 1.000000 | |
| Multivariate Analysis | Patterns and relationships involving multiple variables. |
| Outliers and Anomalies |  |
| **Data Preprocessing Code Screenshots** | |
| Loading Data | sleep=pd.read\_csv("/content/Sleep\_Efficiency.csv") |
| Handling Missing Data |  |
| Data Transformation |  |
| Feature Engineering | Code for creating new features or modifying existing ones. |
| Save Processed Data | Code to save the cleaned and processed data for future use.  sleep = data |