CS210 - Project Report Fall 2023-2024 Sabancı University

Research on My Activity Monitor Data of MacOS

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Introduction

In the realm of macOS, understanding and optimizing resource usage is a crucial aspect that directly impacts the performance and efficiency of applications. The project at hand focuses on delving into the intricacies of resource utilization, particularly examining the correlation between application energy impact and CPU usage.

Data Collection and Preparation

The data collection process involved periodic snapshots of key metrics from the Activity Monitor. This included CPU usage, energy impact, and memory usage at 10-minute intervals. The data was organized into separate sheets in an Excel workbook, with distinct sheets for CPU, energy, and memory.

Sample Data Frames for Each Sheet Type:

`CPU1 DataFrame:`

	Process Name	% CPU	CPU Time	User	Memory	Energy Impact
0	Activity Monitor	12.3	00:06:14.910000	fipek	141.30	102.7
1	WindowServer	21.3	09:27:23.340000	_windowserver	1464.32	53.6
2	sysmond	0.9	00:04:48.720000	root	7.90	7.8
3	coreaudiod	5.8	00:59:29.870000	_coreaudiod	31.70	6.7
4	WhatsApp	0.6	00:08:00.120000	fipek	709.80	3.3

`Energy1 DataFrame:`

	App Name	Energy Impact	12 hr Power	App Nap	% CPU	Preventing Sleep	User	CPU Time
0	Activity Monitor	39	10.78	No	4.1	No	fipek	00:06:16.540000
1	Google Chrome	1.9	125.85	No	1	No	fipek	03:02:20.510000
2	Spotify	1.5	16.53	No	1.6	Yes	fipek	00:07:25.570000
3	Figma	0.4	-	No	0.2	No	fipek	00:20:50.950000
4	Finder	0.2	-	No	0.3	No	fipek	00:39:10.340000

`Memory1 DataFrame:`

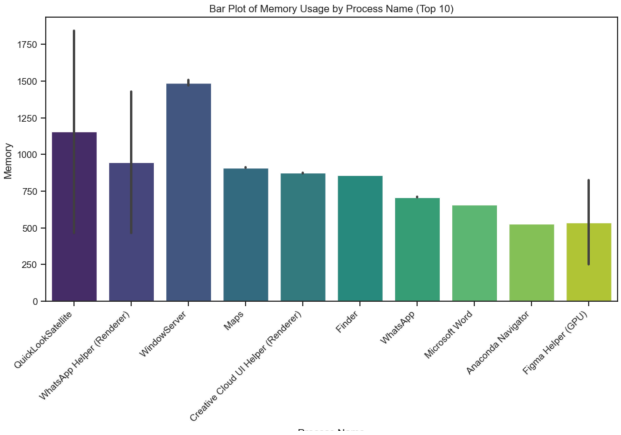
	Process Name	Memory	Threads	Ports	PID	User
0	QuickLookSatellite	2304.00	6	292	24038	fipek
1	WhatsApp Helper (Renderer)	1689.60	22	366	61758	fipek
2	WindowServer	1454.08	29	8321	424	_windowserver
3	Maps	911.40	19	1061	18725	fipek
4	Creative Cloud UI Helper (Renderer)	873.50	32	1086	2492	fipek

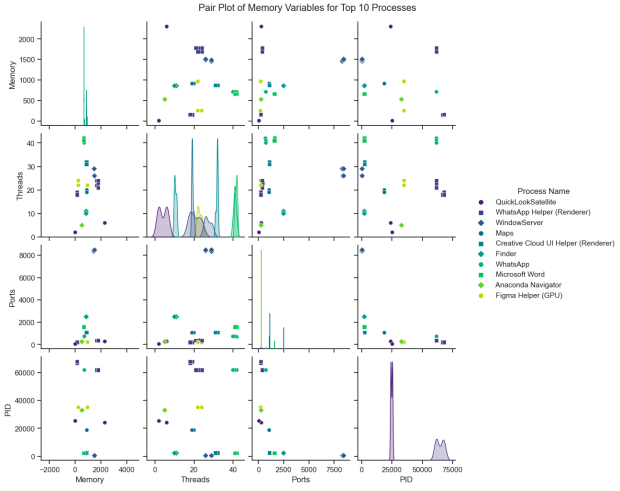
Preliminary Analysis

Descriptive statistics were computed for each metric, unveiling valuable insights into the central tendency, dispersion, and distribution of the data. The correlation between energy impact and CPU usage was a focal point, guiding subsequent analyses.

Visualization

Visualizations were employed to enhance understanding and interpretation. Histograms, pair plots, and bar plots provided a visual representation of the distribution of CPU usage, energy impact, and memory usage. Notably, the top processes were identified based on CPU usage, energy impact, and memory consumption.





Insights and Recommendations

- Top Processes Analysis: The top processes for CPU usage highlighted key applications dominating resource utilization. "Activity Monitor" emerged as a prominent player, indicating active system monitoring. "WindowManager" showcased efficient workspace management, and "Spotify" pointed to entertainment enjoyment.

- Energy Impact Exploration: Examination of energy impact unveiled processes with the most substantial energy consumption. Insights from the top 10 energy-impacting processes shed light on applications demanding significant system resources.

- Memory Usage Investigation: Memory usage analysis identified processes with the highest average memory consumption. The scatter plot of memory usage vs. threads for the top 10 processes provided additional insights into memory patterns.

Hypothesis Testing

A hypothesis test was conducted to ascertain the existence of a significant correlation between application energy impact and CPU usage. The results of the test guided the interpretation of the relationship between these two critical metrics.

Null Hypothesis (H0): There is no significant correlation between application energy impact and CPU usage.

Alternative Hypothesis (H1): There is a significant correlation between application energy impact and CPU usage.

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Pearson Correlation Coefficient: 0.8153099224252177
P-value: 7.102431492512779e-22
Reject the null hypothesis. There is a significant correlation.
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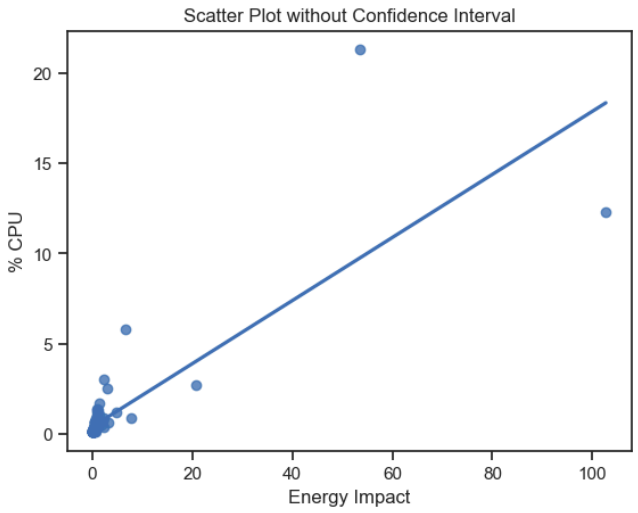

Outlier Analysis

Identification and exploration of outliers in energy impact and CPU usage offered a nuanced understanding of processes exhibiting unusual behavior. Statistical summaries provided a comprehensive view of the data with and without outliers.

Conclusion
The project unveiled a comprehensive understanding of system resource utilization, emphasizing the interplay between CPU usage and energy impact. My user behavior analysis for the individual ('fipek') highlighted a diverse and well-rounded usage pattern, blending productivity, entertainment, and creative activities.

Final Thoughts
This project not only delved into the technical aspects of system resource utilization but also provided valuable insights into user behavior and preferences. The findings serve as a foundation for ongoing efforts to optimize and enhance the overall macOS experience.