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Final Pr oject

Apple Inc.

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# **Introduction**

One of the most well-known brands in the world, Apple is an American manufacturer of computer software, computer peripherals, cellphones, tablet computers, and personal computers. It is the pioneering business in the personal computer industry and is responsible for popularizing the graphical user interface. The company's headquarters are in Cupertino, California. Apple's development of the Apple Watch and its accuracy in tracking health data are prime examples of the company's strategic use of artificial intelligence (AI) and data analytics, which demonstrates its dedication to innovation and consumer pleasure. Through the analysis of market trends, competition strategies, and user behavior, Apple enhances its offerings and offers tailored experiences to its clientele. The dashboard displays discrepancies in tracking health data accuracy between two competitors: Fitbit and Apple Watch. It draws attention to the Apple Watch's reputation for accurate heart rate tracking and the potentially life-saving application of its ECG capability in comparison to Fitbit's capabilities. The dashboard tries to show how Apple Watch's precision sets it apart in the wearable technology market, even though both gadgets provide meaningful information about fitness and health.

# **Apple**

Apple appears to be following the trend of major tech companies implementing AI in some capacity. The business is developing a new health coaching service that leverages artificial intelligence (AI) to customize the customer experience, according to Mark Gurman of Bloomberg. Apple uses business intelligence (BI) and data analytics in all aspects of company operations, including customer service and product development. Apple can create goods that suit consumer wants and strengthen its competitive edge by examining consumer preferences, market trends, and competition strategies. Apple leverages data analytics in sales and marketing to better target its efforts and customize the customer experience. Apple also uses pertinent data analysis to streamline its supply chain, boost security, and improve retail operations. All things considered, Apple's strategic application of BI and data analytics helps businesses make wise decisions, increase productivity, and provide outstanding goods and services to its clients.

Apple Watch health data analytics is a particularly interesting area of data analytics for the company. The Apple Watch uses its sensors and algorithms to gather a variety of health measurements, including heart rate, activity levels, and even ECG data. Following processing and analysis, users receive insightful information about their fitness and overall health. Apple places a strong emphasis on accuracy and dependability in its analysis of health data. Numerous studies have confirmed Apple Watch's reputation for precise heart rate tracking. The ECG component of the device has also received accolades for its accuracy and potential life-saving use in detecting abnormal heart beats. The accuracy of health data varies when the Apple Watch is contrasted with other wearables like Fitbit. Although there may be variations in the precision of specific measures between the two devices, they can both offer insightful information about fitness and health. For instance, research has shown that when it comes to detecting heart rate during vigorous exercise, the Apple Watch typically performs better than Fitbit models. Overall, giving consumers trustworthy and useful health insights is the main goal of Apple's data analytics initiatives with the Apple Watch. It will be interesting to watch how Apple develops its health tracking features going forward, as wearable health technology is still in its early stages.

Apple uses artificial intelligence (AI) and data analytics in several ways to improve customer experiences and business choices. These include:

1. Product Development: To inform the creation of new features and products, Apple analyzes user behavior, market trends, and customer feedback with the use of artificial intelligence (AI) and data analytics. For instance, Apple's virtual assistant Siri improves user experience by using AI to comprehend and react to user commands.
2. Personalized Recommendations: Based on user behavior and preferences, Apple employs artificial intelligence (AI) algorithms to offer users personalized recommendations. These recommendations may include news articles, music, or apps. This improves user experience and encourages interaction with Apple's network of goods and services.
3. Operational Efficiency: Apple optimizes its supply chain and operations using artificial intelligence (AI) and data analytics. Algorithms driven by artificial intelligence (AI) have the potential to enhance efficiency and reduce costs by predicting product demand, optimizing inventory levels, and improving logistics.
4. Enhanced Security: Apple employs AI to make its products and services more secure. AI systems, for instance, can examine user behavior patterns to identify and stop fraudulent activity, giving clients a safe and secure experience.
5. Health and Fitness: Apple leverages AI and data analytics to power wearables like the Apple Watch and the Health app. These features can track and analyze health metrics, provide insights into fitness levels, and even detect potential health issues, helping users lead healthier lives.

In general, Apple can make data-driven business decisions, improve its goods and services, and offer individualized experiences for its customers because to its strategic use of AI and data analytics. Apple's product development and strategic decision-making processes rely heavily on business intelligence (BI) and data analytics. Apple obtains profound insights that inform its business strategy by analyzing enormous volumes of data, including rival performance, market trends, and customer preferences. Apple, for example, employs data analytics to comprehend how users engage with its goods and services, enabling the business to enhance user experiences and customize offers to satisfy certain requirements. Furthermore, data analytics aids Apple in demand forecasting, effective inventory management, and supply chain optimization, guaranteeing that goods are available when and where customers need them. Additionally, Apple can provide individualized services and recommendations by utilizing AI and machine learning, which will increase customer pleasure and loyalty.

With its devices seeing widespread adoption as industrial technology advances into what is known as Industry 4.0 – connected systems enhanced by AR and mobile solutions – Apple has joined the production infrastructure. The Fourth Industrial Revolution (I4.0) denotes a dramatic change in production toward a digital transformation where virtual and real-world barriers are blurred, and processes become more digitally automated. This revolution has the potential to improve overall quality and productivity, enable mass customization, increase pace of operations, and improve production systems' adaptability. Companies must, however, invest heavily in machinery, ICT (information and communication technologies), data analytics, and data integration throughout the value chain to reap these benefits. This expenditure runs the risk of upsetting established procedures and can be quite expensive. To navigate Industry 4.0, leadership is essential because it calls for strategic decisions to be made at all organizational levels. Future leaders will have to be extremely adaptable, able to spot trends in network data, and able to engage with a variety of stakeholders in a setting that is always changing. To truly understand the science of connectedness and organizational network learning and to prosper in the I4.0 era, they need to build connected networks and organizations.

Apple has a large and diverse impact on world needs. Apple has achieved a significant milestone with the Apple Watch, its first carbon-neutral product, as part of its plan to make all products carbon neutral by 2030. This achievement is the result of innovations in materials, clean electricity, and low-carbon shipping, which have helped reduce most emissions. To offset the remaining emissions, Apple is investing in nature-based projects. This commitment reflects Apple's urgency in addressing environmental challenges, demonstrating that the company is taking proactive steps to reduce its carbon footprint and protect the planet. Apple has supported societal needs and addressed several global concerns with its goods and services.

1. Communication and Connectivity: People all over the world can now interact, cooperate, and remain connected more readily thanks to Apple products like the iPhone, iPad, and Mac. These gadgets have completely changed communication and connectivity. This has been crucial for allowing access to information and services, remote work, and educational environments.
2. Education & Learning: With its educational apps, digital textbooks, and products like the iPad, Apple has contributed to the transformation of education. These resources have benefited students and educators all throughout the world by making learning more participatory, interesting, and accessible.
3. Healthcare and Well-Being: With Apple Watch and other health and fitness features, people can now take charge of their health and well-being. Examples of these features include the health app. These devices can track exercise levels, keep an eye on vital signs, and even identify health problems, which could save lives and enhance general health results.
4. Environmental Sustainability: Apple has significantly lessened its influence on the environment. The company has pledged to be carbon neutral throughout its whole supply chain, create products with recyclability in mind, and power its facilities using renewable energy sources. These initiatives help achieve global sustainability goals and serve as a model for other businesses.
5. Economic Growth and Innovation: Apple's success has aided in both areas, directly and indirectly, through the development, supply, and retail partners that make up its ecosystem as well as the products and services it offers. The company's inventions have benefited consumers all around the world by fostering competitiveness and technological breakthroughs.

Apple has a significant overall impact on the needs of the world, and as long as it keeps innovating and adapting to the changing needs of both its clients and society at large, it will probably continue to be successful.

In order to broaden its product offering and provide a gadget that enhances its current ecosystem of goods, Apple developed the Apple Watch. The Apple Watch was intended to be a flexible wearable that worked well with other Apple devices, including the Mac and iPhone. With a host of features including fitness tracking, notifications, and health monitoring, it's a useful tool for anyone trying to remain in touch and monitor their fitness and health objectives. Furthermore, the Apple Watch has strengthened Apple's brand presence in the fitness and health sector and allowed it to capitalize on the expanding wearable technology market. Fitbit is also a well-known wearable gadget that focuses on tracking fitness and keeping an eye on health. It has several functions, such as exercise modes, heart rate monitoring, activity tracking, and sleep tracking. Fitbit gadgets are made to encourage users to be active, establish and achieve fitness objectives, and track their advancement over time. The two watches are different in a few important ways. Along with a high-end design, configurable options, and access to a vast selection of apps via the App Store, the Apple Watch smoothly combines with other Apple products. Fitbit devices, on the other hand, have less customization choices and are standalone devices with an emphasis on functionality rather than a wide range of apps. The Apple Watch often has more sophisticated health monitoring functions, like ECG monitoring and fall detection, even if both devices have fitness and health features. Apple gathers and analyzes user data, including heart rate, activity levels, and workout information, to improve the accuracy of the Apple Watch through data analytics. Machine learning techniques are used to process this data in order to find abnormalities and increase measurement accuracy. Extensive testing and user input help algorithms become even more refined and improve overall performance. Cross-referencing health metrics to increase accuracy is made possible by integration with iPhone health apps. The dataset chosen is of health data from two devices, Apple Watch and Fitbit. Below is the Data Dictionary for the dataset.

Data Dictionary:

|  |  |
| --- | --- |
| **Column Name** | Description |
| X1 | Index of the observation |
| age | Age of the person in years |
| gender | Gender of the person (1 for male, 2 for female) |
| height | Height of the person in centimeters |
| weight | Weight of the person in kilograms |
| steps | Number of steps taken |
| heart\_rate | Heart rate in beats per minute |
| calories | Calories burned |
| distance | Distance covered in meters |
| entropy\_heart | Entropy related to heart rate |
| entropy\_steps | Entropy related to steps taken |
| resting\_heart | Resting heart rate in beats per minute |
| corr\_heart\_steps | Correlation between heart rate and steps |
| norm\_heart | Normalized heart rate |
| intensity\_karvonen | Intensity calculated using the Karvonen method |
| sd\_norm\_heart | Standard deviation of normalized heart rate |
| steps\_times\_distance | Product of steps and distance |
| device | Device used for data collection (Apple Watch, Fitbit) |
| activity | Activity being performed (e.g., Lying) |

Table 1: Data Dictionary of Dataset

Metrics including age, gender, height, weight, steps, heart rate, distance traveled, calories burned, and more are included in the dataset that is linked to physical activity and health. The dashboard's analysis of this data is intended to provide insights into trends in fitness and health.

A screenshot of a graph

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Figure 1: Dashboard – Apple Watch

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Figure 2: Dashboard - Fitbit

The dashboard displays a comparison of Fitbit and Apple devices' tracking accuracy for physical activity. There are separate graphs for every statistic, including average intensity of physical activity, height and weight distribution, steps vs. distance, calories burned by exercise, and resting heart rate boxplot. These infographics illustrate the disparities in accuracy between Fitbit and Apple products, offering consumers insightful information to help them choose their fitness trackers wisely. The dashboard has been created using Tableau to compare the accuracy of Apple and Fitbit devices in tracking physical activity metrics.

Figure 3 is titled as Calories burnt by the Activity.

A graph of a running

Description automatically generated with medium confidenceA graph of different colored bars

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Figure 3.2 – Fitbit – Bar Chart

Figure 3.1 – Apple Watch – Bar Chart

The bar graph compares the calories burnt for different activities as tracked by Apple and Fitbit devices. It helps users understand which activities result in more calories burnt and how the accuracy of calorie tracking differs between the two devices. The age filter ranges from 18 to 56 years. Those who wear Apple watches burn more calories when they lie down, while Fitbit users report burning the fewest calories when they do the same.

A graph with many dots

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Figure 4.1 – Apple Watch - Scatterplot

A graph with numbers and dots

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Figure 4.2 – Fitbit - Scatterplot

The link between the distance traveled and the number of steps taken is depicted in this graph. We can observe whether there are any differences in the measurements made by the two devices and how closely they track these data. In Figure 4.1, the data from an Apple Watch exhibits a linear trend, while the Fitbit data graph displays no discernible correlation between the two variables for the same age group. This shows the accuracy of Apple Watch over Fitbit.

A screenshot of a graph

Description automatically generatedA graph with a bar and a line

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Figure 5.1 – Apple Watch – BoxPlot

Figure 5.2 – Fitbit – BoxPlot

The distribution of resting heart rates that Fitbit and Apple devices have recorded is shown in this boxplot. It enables users to assess any variations in the devices' performance by comparing the devices' accuracy in determining resting heart rate. Men have a resting heart rate of 66 bpm, whereas women have a resting heart rate of 75.7 bpm according to the Apple Watch BoxPlot. On the other side, Fitbit's data appears to show more outliers and does not appear to create a boxplot.

A screenshot of a computer

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Figure 6.1 – Apple Watch – Treemap

A screenshot of a computer screen

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Figure 6.2 – Fitbit – Treemap

An individual's average level of physical activity is a measure of how demanding their activities are over time. It is frequently computed using variables like heart rate and perceived exertion. The "Intensity Karvonen" column in this dashboard is used to indicate the level of physical activity. The Karvonen formula, which considers both an individual's maximum heart rate and resting heart rate, is used to compute the "Intensity Karvonen" measure. The goal heart rate range for aerobic exercise, which is crucial for enhancing cardiovascular fitness, can be found using this formula. People can make sure they are exercising at the right level to meet their fitness objectives by tracking their physical activity intensity using the Karvonen formula.

It makes sense that the Apple Watch's tree map indicates that running seven METs requires the highest effort, followed by running five METs, running three METs, and so on. Fitbit claims, however, that running 5 METs demands more strength than running 7 METs, which is illogical and indicates that the Apple Watch is more accurate than Fitbit.

A graph of weight distribution

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Figure 7.1 – Apple Watch – Histogram

A comparison of weights and weight distribution

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Figure 7.2 – Fitbit – Histogram

The dashboard's height and weight distribution chart show how these physical attributes are distributed throughout the dataset visually. In terms of height, the chart might provide a bar graph or histogram that shows the percentage or frequency of people at various height ranges. This might assist in locating any outliers and typical height ranges within the sample. A histogram or bar graph representing the frequency or proportion of people at various weight ranges may also be displayed on the weight chart. This can be used, like height, to find outliers and typical weight ranges in the dataset. The distribution of height and weight can be visualized to provide us with further information on the physical attributes of the dataset's subjects. Understanding the dataset's demographics and the potential effects of height and weight on fitness and health measures like calorie burn, steps taken, and physical activity intensity may be done with the use of this information.

# **Conclusion**

In conclusion, the dashboard that contrasts Fitbit and Apple Watch monitoring accuracy for physical activity offers insightful information about how the two competitors differ from one another. The dashboard shows how Apple Watch generally works better than Fitbit in terms of accuracy through a variety of graphs and charts, including the comparison of calories burned by activity, steps vs. distance scatterplot, and resting heart rate boxplot. The examination of the data also emphasizes the significance of features like accurate heart rate tracking and ECG capabilities, which support Apple Watch's reputation for accuracy in data monitoring related to health. All things considered, this dashboard is a helpful resource for customers wishing to choose their fitness trackers wisely, highlighting the advantages of Apple's astute application of BI and data analytics to improve the user experience.

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