

DELFT UNIVERSITY OF TECHNOLOGY



HIGH-TECH MARKETING
MOT133A

Group Assignment 2023-2024

Apple Watch - Oura Ring - Garmin Watch

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1 Introduction

With increasing mental health awareness and a growing emphasis on wellness, health tracking has become an important aspect of modern life. This shift is supported by technological advancements in the wearable industry, particularly in smartwatches. By 2024, the global market share for fitness trackers is projected to achieve \$74.61 billion, with an annual growth rate of 8.47% (Statista, 2024).

In this landscape where innovative companies are outperforming their traditional counterparts, we believe there is a huge potential for smart wearables as a product category. Our project focuses on the fitness-tracking wearables market, exploring the offerings of three prominent brand products.

As brand 1, the Apple Watch stands as the established market leader, known for its comprehensive fitness tracking capabilities and ecosystem benefits. For brand 2, the Oura Ring, a high-tech smart ring, represents the new wave of potential disruptors in the wearable market with its unique features. Lastly, for brand 3, Garmin, an established player in the fitness industry, continues to hold a niche with its expertise in navigation systems and has a significant market position with its specialized fitness tracking capabilities.

2 Product 1 - Apple Watch

2.1 A Review Of The Brand History and Value Proposition

Brand History CEO Tim Cook introduced The Apple Watch in April 2015 along with the iPhone 6. Initially, the watch was marketed as a fashion accessory, but its focus shifted to the fitness-oriented features on its official release. With an upgrade cycle from 1 to 2 years, Apple, over time, has implemented more and more technology into their products, including a faster processor, GPS, brighter display, bigger battery, and many more. Advanced features with a health focus, such as Fall Detection, blood pressure, and blood oxygen level measurement, are all centered around a message that you can live a better, healthier life with this device. (Verizon, 2021)

When the Apple Watch first launched, it was the first new Apple product since the iPad. According to the Slice Intelligence analytics firm, Apple experienced a sharp drop in demand for the Apple Watch from 35,000 per day to only 5000 per day after its launch (Quartz, 2023). At the moment, Fitbit was leading the race in the smartwatch industry. And in 2015, Fitbit went public, sold 21.4 million devices.

Apple was not the first player in the market. The adoption of Apple products was slow in the beginning. The turning point was the Watch Series 2 released in 2016 with GPS and health features that people can use without an iPhone. Then, it started picking up the pace, and in 2017, the product team focused more on fitness and health features instead of giving the watch a more appealing appearance. Fitbit held the record for most products shipped in a fiscal quarter (6.1 million) until 2017 when Apple took the throne in the fourth quarter with 8 million units shipped worldwide. Fast forward to today, Apple has finally become the largest player in the smartwatch game, with a 31% market share in the last quarter of 2023. (Statista, 2023)

Market Position Apple Watch is a leader in the smartwatch market while its next-in-line competitor has only 10%. It dominates the smartwatch category with a substantial market share, outpacing competitors like Samsung, Garmin, and Fitbit. Its success is reinforced by Apple's strong brand loyalty and expansive retail presence. In 2017, the brand leapfrogged Rolex to become the number one watch in the world (Finance, 2023).

Value Proposition *"Apple Watch can do what your other devices can't because it's on your wrist. When you wear it, you get a fitness partner that measures all the ways you move, meaningful health insights, innovative safety features, and a connection to the people you care about most."* (Apple, 2023)

Mission Statement *"To bring the best user experience to customers through innovative hardware, software, and services."* (Hub, 2023)

Significant Features Differentiating Apple Watch

Innovative Features:

- Health and fitness tracking: Advanced health monitoring features like heart rate monitoring, ECG (electrocardiogram), blood oxygen monitoring, and an integrated fitness tracker that supports various activities.
- Seamless integration with the Apple ecosystem: The watch works fluidly with other Apple devices in a way that its competitor lagged behind.
- Customizability and personalization: A variety of bands and watch faces to choose from, so users can personalize their device according to their preferences.
- Unique selling proposition: The watch is a symbol, a lifestyle. Apple Watch aims at convenience and is an iPhone extension rather than a complete replacement.

Vulnerabilities:

- High price point: The high price point of Apple Watch makes it less accessible to a broader market, providing an opportunity for lower-cost competitors.
- Locked in the ecosystem: Unlike some of its competitors, most Apple Watch functionalities require a connection to an iPhone, limiting its market to existing iPhone users.
- Battery life: While improving, the battery life of Apple Watch still lags behind some competitors who offer multi-day usage with a single charge.

Point of Parity & Point of Difference

Point of Parity: - The Apple Watch is not only a timepiece but also a health and fitness companion. It provides basic smartwatch functions such as notifications, calls and messages, calendars, and several more basic applications. Fitness tracking, Bluetooth connectivity, GPS, and water resistance are standard features among smartwatches today that are considered a must-have by most users.

Point of Difference: - Apple Watch's seamless integration with other Apple products makes the user experience as smooth as possible. In addition, aesthetic and design flexibility offers customers personalization opportunities more than other typically available smartwatches on the market. Apple set itself apart from other competitors with its advanced health monitoring, making it appealing to health-conscious consumers and those monitoring specific health conditions.

2.2 A Competitive Strategy

The Apple Watch follows a traditional product life cycle. As part of its introduction phase, sales were slow initially when users needed time to get familiar with the new product. Right now, the Apple Watch can be considered in its maturity stage since Apple has become the market leader for smartwatches. The decline stage does not seem close yet, and Apple, with continuous innovation, will try to delay it as long as possible to sustain profits. Despite its best fit with the traditional product life cycle, the Apple Watch also resembles the long tail product life cycle. Apple Watch originally wanted to position itself as a fashion item but found another niche market when it developed health features. This, in turn, attracted the attention of health-conscious individuals and tech enthusiasts, helping Apple gain its focus on health as it is right now.

From its success story, the Apple Watch's competitive strength can be seen as follows:

Product Differentiation

- Design and customization: Its original fashion accessory position did not fare well. However, in the long term, when the brand established a strong market position, the numerous band options and the customizable faces became a tool for customers to express themselves. It provides personal aesthetics, with everyone being a unique individual, through a wide range of tastes and styles.
- Ecosystem integration: Another selling point of Apple Watch lies in its unique integration with the Apple ecosystem. From features like Apple Pay, unlocking other Mac devices, and other compatible applications, the watch locks the user in the convenience of its surrounding product, enhancing their overall experience.
- Feature innovation: Apple may not be the first to market a product. However, it usually takes the lead in feature innovation. Some notable capabilities, such as ECG, blood oxygen monitoring, and

personalized fitness applications, position the Apple Watch as a wellness companion rather than just a stopwatch.

Marketing Positioning

- Premium branding: Apple positions its Watch product in a premium category. Some people argue that its high pricing will reduce the number of potential buyers. However, it stays consistent with its wider product branding strategy. It is not just a tech gadget but a luxury and lifestyle product. These selling points make it extremely appealing to status-conscious consumers, especially young adults and teenagers, who are easily affected by their surrounding friend circle.(of Economic Research, 2023)
- Broad consumer base: Taking its reputation as an advantage, Apple makes the Watch highly compatible with the iPhone, which is the leading product in the mobile market in the US with a 60.77% in 2024(Backlinko, 2023). The product invited its already-established user base to purchase it as an upgrade to the phone and their lifestyle.
- Health and fitness focus: Seeing a potential growth in interest in personal health, Apple timed its entrance perfectly to tap into the growing consumer with a high interest in health monitoring. The branding of the Apple Watch surrounds its capability to create a healthier and more convenient lifestyle.

Strategic Partnerships and Collaborations

- Health industry collaboration: Apple actively seeks collaboration with the healthcare industry, research institutions, and insurance companies to stay ahead of its game. Being the first to release an innovative feature for a healthier life, is directly related to the product image. For example, notable collaborating partners vary such as Harvard T.H. Chan School of Public Health and the National Institute of Environmental Health Sciences, Brigham and Women's Hospital and the American Heart Association, the University of Michigan, University Health Network, and the Digital Mental Health Study with UCLA and World Health Organization and many more. It is noteworthy that the Heart Failure Study can be a starting point for prospective features that can shape the product as irreplaceable in at-home healthcare monitoring. (Australia, 2022)
- Fashion and brand collaboration: Over the years, Apple has expanded its collaboration with high-end fashion brands such as Hermes to release limited edition versions of the watches. Its collaboration with Nike targets a fitness community focusing on sports functions. It is a good strategy to use other brand reputations and refresh its image as a luxury brand while offering an active lifestyle.

Based on these factors, Apple Watch should take a "Proactive Marketing Strategy"

Considering Apple's resources, market positions, reputation, and previously mentioned competitive strength, the Apple Watch should adopt a mix of anticipative and creative marketing strategies. The anticipated approach is because Apple has been leading the health innovation and its products are known for the seamless integration with other devices in its ecosystem. The creative approach also makes sense because as seen in the past, Apple needs to stay ahead of the curve with innovative product features. In the Watch case, deeper integration with household systems or personal security features can be the next potential development.

2.3 A Marketing Plan

2.3.1 Situation Analysis

Market overview: The smartwatch market is growing gradually due to the increasing number of customers interested in health monitoring. As the market leader, Apple faces serious competition from other major brands such as Samsung, Garmin, Fitbit, and Oura. Each offers unique features at various price ranges. In addition, the Android phone has a 70.69% market share, presumably offering competitors supporting Android, a broader audience.(Backlinko, 2023)

Customer insights: Apple Watch users are tech-savvy individuals loyal to the Apple brand. Because of its seamless integration, analysis shows that nearly 80% of iPhone users now own an Apple Watch. Although

the product has a friendly user interface, it comes with a relatively short battery life compared to other products, making it an unappealing point for many consumers (Times, 2023).

2.3.2 SWOT Analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> • Product differentiation with innovative and feature-oriented design • Widespread brand recognition and strong brand loyalty • Attractive health-oriented initiatives for a broader user base • Apple ecosystem • Strong customer relation and service team • Highly durable product • Customizable to user's preference 	<ul style="list-style-type: none"> • High price point concerns price-sensitive consumers • Requires commitment to the Apple ecosystem (iPhone needed) • High maintenance and repair cost • Limited recent innovations
Opportunities	Threats
<ul style="list-style-type: none"> • Collaborations with healthcare industry and institutes • Growing smartphone usage in emerging markets as a stepping stone • Incorporate AI models • R&D towards sustainable product 	<ul style="list-style-type: none"> • Intense competition from other brands with lower prices • Stringent healthcare regulations and privacy concerns • Counterfeit products

Table 1: Strengths, Weaknesses, Opportunities, and Threats of Apple Watch

2.3.3 Marketing Mix 7P Framework

- **Product:** Potential directions could be expanded by monitoring parameters such as hydration levels or new sensors for measuring blood glucose. This could enlarge the customer base by bringing new users with specific needs. Integration is one of the main selling points of the Apple ecosystem. Features that can link other devices in the user's daily life are highly appreciated, such as between Macbook or iPad or even media systems on a personal vehicle.
- **Price:** Similar to the introduction of the iPhone SE, Apple has released a more affordable model to attract a larger audience, the Apple Watch SE. The distinction lies in the basic and exclusive features reserved only for premium models. Releasing a cheaper model has to be done carefully else it could risk sales of its premium products. Apple should highlight the long-term cost benefits of owning an Apple Watch compared to traditional healthcare costs for users, with the philosophy of "Prevention is always better than cure." Early detection of abnormalities will help everyone live a healthier life.
- **Place:** Apple can expand the market to emerging countries with increasing disposable income. Partnerships with national telecom companies will allow Apple to use its facilities and online websites to distribute bundled products through already-established local channels.
- **Promotion:** As previously mentioned, Apple's collaboration with the health industry promotes a positive image, showing its interest in elevating health benefits and reinforcing its value proposition through the health-focused campaign.
- **People:** Improving customer services will enhance user experience and reinforce the user's loyalty to the brand, hence having a higher customer retention rate.
- **Processes:** Customer feedback should be taken seriously. Therefore, improving the customer feedback system to gather and analyze accurate customer feedback data will help to respond quickly to market requirements and change requests.

- **Performance:** Apple has done a great job transforming its retail stores into experience centers where users can freely interact with the products. In addition, Apple also invests a lot of time in training passionate employees who can help customers optimize their shopping experience. Apple values small gestures and creates a code of conduct for greeting customers from its Apple acronym, making every interaction with store employees memorable and pleasant. (Future Stores, 2023; Retail, 2023)

2.3.4 Marketing Strategy

Apple's marketing strategy for Apple Watch should defend its leadership status while preventing it from being leapfrogged by other competitors.

Based on the previous analysis of brand history, market, and competitive strategy, Apple Watch enjoys its market leader position but must be ready to safeguard it. Once a new player is in the ground, the immense capital gained from other Apple flagship products has protected it from the initial hardship timeline many start-ups usually face when entering the market. Apple Watch leapfrogged Rolex to become the number 1 watch brand, and now it must be ready to protect itself from being displaced by other players.

2.3.5 Marketing Tactic

1. Direct Email Campaigns for health-conscious, tech-savvy users on new health features, latest tech enhancement for creating the hype
2. Influencer partnerships and social media challenges to encourage user participation and content creation.
3. Loyalty Rewards Program for users actively participating and attracting more attention from others who haven't been engaged in the fitness challenge. Virtual event, conference for new product announcement
4. Interactive retail experiences for customers to try out with the support of knowledgeable staff.
5. Ads with real-life testimonials for demonstrating the usefulness and reliability of the product in extreme, life-threatening situations.

3 Product 2 - Oura Ring

3.1 A Review Of The Brand History and Value Proposition

Brand History Oura is a Finland-based health-tech start-up company that focuses on providing wearable tracking technology for health and sleep data tracking. The company was founded in 2013 to accurately track body data via means of a finger ring. Their roots are in the world of sleep tracking, with a team full of sleep physiology experts. With successful product orientation, the company showed success by having sold over a million rings across the world with an average price of a ring lying at US\$400 (Heater, 2022, March 24; Oura, 2021).

While the brands in the market are focusing on constantly improving the smartwatch features, Oura has taken a unique approach of coalescing the traditional attire with high-end technology –Ring. Their motive lies in staying as simplistic and subtle as possible. The ring weighs roughly 4-6 grams and does not require much maintenance apart from charging it once per week. This makes it tempting for the customers, as it helps them seamlessly go on with their daily activities without being too concerned/worried about constantly keeping a check on their watches. They hardly even notice that a device is on them due to its subtle presence, which makes the integration into daily life much more fluid. Over the years, the company also achieved the award of 'Best Consumer Wellness Company' and '100 Best Inventions of 2020'. Moreover, Oura has raised multiple funds from various capital ventures and has also acquired a digital identification tool-making company, Proxy Inc. (Team, 2024, April 22). This acquisition can supplement Oura to introduce the concept of user identification towards increased privacy and protection of precious data.

Market Position Oura initially started targeting companies/researchers studying the sleep cycles and well-being of users. They targeted high-end health-conscious users willing to track their wellness data. However, over the years, with advancements in technology, lowered costs, and increasing stress awareness

all around the world, more people are skewing towards health tracking. While a few years ago, only medical-grade equipment could accurately track user data, wearable technology has taken a huge leap in this market, facilitating users to check vitals at their fingertips. Oura has also deciphered a market among enterprises willing to track their employee data for better insight into the company's efficiency. With this, they are competing head on with watch companies like Apple, Fitbit, and Garmin.

Now, Oura is making attempts at targeting a new audience, who are more than willing to use this subtle seamless product for accurate predictions - Sports/Fitness sector. To expand outreach, in 2020, Oura formed partnerships with the National Basketball Association (NBA) and WNBA, causing huge leaps in the sports world. The waves can be seen among people using the Oura ring to track triathlon performances, military training, and professional trekking (Holmberg, 2024, April 18; Lomas, 2024, March 4; Team, 2024, February 14, 2023, July 11)

Value Proposition “Through the Oura Ring and Oura App, individuals have access to personalized health data, insights, and daily guidance in the form of a ring. By the very nature of a ring form factor, the Oura Ring is designed to fit within an individual's life, not disrupt it” - Harpreet Singh Rai, Former CEO, Oura Health (Team, 2021, May 4)

Mission Statement “Our mission is to make health a daily practice.” “At Oura, our mission is to empower every person to own their potential and control the course of their health.” - Harpreet Singh Rai, Former CEO, Oura Health. (Team, 2021, May 4)

Significant features differentiating Oura Ring

1. **High Accuracy:** Backed by research, data collected from fingers are comparatively more accurate than other competitive products in the market. The ring achieved a high correlation with medical-grade ECG equipment while measuring Resting Heart Rate [RHR] (99.9%) and Heart Rate Variability [HRV] (98.4%). The Oura ring measures directly from the finger arteries which are close to the sensors, unlike other smartwatches, making it more accurate. Oura utilizes infrared photoplethysmography (PPG), with sensors on both sides of the finger, which helps in penetrating deeper into the skin with more clear screening. (Kinnunen et al., 2020)
2. **Temperature Detection:** The only tracking device that can accurately measure body temperature every minute, which eventually opens up a plethora of tracking possibilities. The ring measures the skin temperature with medical-grade accuracy to within 0.36 degrees Celsius, correlation of 99.3%, and detects changes as low as 0.13 degrees Celsius. (Kryder, 2020, December 7)
3. **Less Distraction:** No screen and vibration creates noise in the dataset.
4. **Aerospace-Grade Alloy:** The product is made from highly durable Aerospace-grade titanium alloy.
5. **Simplified and Effective Data:** The information tracked is analyzed and coalesced into three simple criteria: Readiness score- ‘How ready are you for the day?’ ;Sleep Score- ‘How well did you sleep last night?’ ;Activity Score- ‘How well are you balancing your activity and rest?’ . (Team, 2024, February 7)
6. **Integration with Other Apps:** The Oura ring is compatible with various tracking systems such as Apple Health, Strava, Android Health Connect, Google Fit, Natural Cycles, Zero Fasting App, and Continuous Glucose Monitor. (Team, 2024, June 6)

Supplementary Products

1. **Oura Membership:** The scheme provides users with detailed sleep analysis, nuanced health insights, temperature sensing for detecting illness, understanding recovery time, observing constant vital trends, and so on. The membership costs \$5.99/month or \$69.99/year. (Team, 2024)
2. **Oura Cloud:** This system allows the user to have an overview of all the data that the ring has collected over days, months, and years, and analyze the pattern.
3. **Oura API:** This allows developers from third-party applications to access unfiltered sensor data and metrics which helps in expanding the usage of data to various other possibilities. (OuraTeam, 2024)

4. **Oura Business:** This platform allows businesses to measure the health data of their employees, and suggests group-level trends in the amount of fatigue, exhaustion, happiness, relaxation state, performance levels, etc. which helps to further optimize the running of the company.

Point of Parity Oura Ring has multiple points of parity: It tracks daily activity, physical exercise, sleep tracking (different stages), heart rate monitoring, calorie count, and application integration with mobile devices. Even though, the company can argue that they are the best at measurement quality, most of these features are considered classic features among industry-standard smartwatches with good enough accuracy.

Point of Difference Oura's uniqueness lies in its sleek and subtle design without distracting features, which makes the integration of the product into the user's life very inconspicuous. The ring's uniqueness lies in its ability to track sleep to the utmost accuracy (highly comparable to medical-grade equipment), analyzing different sleep stages, patterns, and highly personalized recommendations. The ring also constantly measures the skin temperature which helps analyze many other important info. Furthermore, the ring is supported by scientific research to provide highly accurate information that reinforces its credibility and usage.

3.2 Competitive Strategy

Throughout fitness tracking, the dominant companies such as Apple and Garmin have already identified the customer need for the product and developed the foundation of the market segment. To benefit from the track established by these giants, Oura can utilize **Long-Tail Life Cycle** to target the niche consumer fitness segment. This life cycle comprises introducing products in a niche market, sales growing steadily and moderately in the growth stage, balanced product sales during the maturity stage due to a stronger loyal base, and continued endurance of the product with improved customer engagement.

Oura can follow a similar strategy by associating the product with a niche target base catering to highly specialized areas of development/service. By attracting users focused on fitness, though the overall expansion rate of the company might be comparatively moderate, the strong foundation will leverage the company to strengthen its credibility and reliability among consumers. With multiple fitness collaborations in line, Oura is currently in the '**Growth**' stage where it is constantly exploring new untapped features and making it more consumer-friendly.

Oura Leapfrogging Apple: While Oura boasts itself with a strong product backed by official studies, it cannot tackle head-on (frontal attack) with Apple Watch's business model given its sheer size, finance, product loyalty, and market capture. Hence Oura can benefit from the following:

1. As described by Kotler Keller (Kotler & Keller, 2016), Oura can utilize **the Bypass Attack Strategy** to identify market shifts and satisfy them by providing simplistic, non-distracting wearable devices (currently in an uncovered market state but slowly getting attraction). This is favorable since the company can involve this strategy with limited resources, focusing on customer feedback and niche consumer targeting.
2. With product improvement, Oura can expand its value offering to other geographical areas (For example, users in extreme environmental conditions) where the technological developments of Apple and Garmin are still in a rudimentary stage.
3. With **Flank Attack Strategy**, Oura can capitalize on its highly advanced and accurate body vitals tracking feature and collaborate with brands to have features like mental health, fitness programs, dietary plans, and stress vitals under its wing.

Oura defending against Garmin: With such a novel product, Oura's marketing skills must focus on being **anticipative**, i.e., identifying the future needs of customers and providing radical solutions. With fierce competition, Oura constantly must be on the lookout to defend itself by offering new solutions:

1. Oura's uniqueness lies in its product's nature - ring, and it should focus on building on this image to achieve **Position Defense**. It can achieve this by constant product improvement, increased customer loyalty, better customer engagement, ecosystem development, and eventually striving to become 'generic trademark' by defining the industry standard.

2. Oura can implement **Mobile Defense** by catering to athlete health tracking institutions that monitor players' health in a professional context. They already have a research-backed, almost medical-grade product and with a bit more R&D they can secure their place. This leaves the door open for them to expose themselves to the world of many sports institutions.
3. Oura is building a strong foundation for expansion by currently collaborating with 600+ companies in various areas of expertise ranging from birth control (Natural Cycles), Continuous Glucose Monitoring (CGM) (January, Veri, Supersapiens), metabolic health (Hello Inside), habit building (Noom), mental health (Talkspace, Headspace), social fitness (Strava) and many more (Team, 2024, June 6). Strengthening the **Partner Relationship Management (PRM)** can help Oura defend itself by reinforcing its value in the market.

3.3 Marketing Plan:

3.3.1 Situation Analysis:

1. Market stage: Oura's current market targets include human body researchers, health-conscious professionals, and women's health, with a recent kickstart in the sports arena by collaborating with giants such as Real Madrid (football) and the NBA.
2. Financial: The company has raised \$148.3 million over 9 funding rounds, backed by 46 investors. The value of the company lies at US\$2.5 billion, which is abstract because the data is not publicly available.
3. Product: The ring is mainly available online, with few physical stores across the world, negatively impacting its global presence. Furthermore, it mainly sells D2C, unlike its competitors boosting their sales with partnerships and other B2B deals. There are also just two main product offerings currently that limit consumer choices.
4. Competition: The product competes with current fitness tracking giants like Apple, Fitbit, and Garmin, as well as upcoming ring wearable companies –Ultrahuman, Ringconn, and Amazefit. Among the ring companies, Oura is at the forefront, however, in overall fitness wearables, it still has a lot of pushback.
5. Macroenvironment: The global wearable industry in 2023 was estimated to have a valuation of US\$ 128.07 billion with an expected CAGR of 12.0% [forecast period 2023-2030]. The region North America currently leads the market share with 34%, followed by Asia Pacific and European region, with Asia-Pacific expected to grow the fastest in the coming years. The fitness and wellness sector gains the maximum share of the wearables with 31% under its wing. (Insights, 2023, June)

3.3.2 SWOT Analysis

Strengths	Weaknesses
<ul style="list-style-type: none"> • Simplistic design • No distractions • Research backed precise data • Strong reputation in research, academic and health focused community • Temperature sensing • Daily recommendation for users based on sleep, health monitoring and activity 	<ul style="list-style-type: none"> • Expensive (\$400) + Subscription (\$5.99/month) • Users rely on mobile phone/tablets to check their data • Lack functionality like GPS • Customized for finger size and multiple sizes. Precise size required for exact measurement • Few retail presence • Less product offerings (only 2 styles)
Opportunities	Threats

<ul style="list-style-type: none"> • Expansion in sports focused offerings • Expansion in Asia and South American countries, where the product is sparsely launched • Target young population as a youth statement • Collaboration with health institutions for their patient health tracking • Fancier design options for fashion enthusiasts 	<ul style="list-style-type: none"> • Tremendous competition from huge players in fitness wearable industry • Pricing displayed to the consumer seems expensive • People like changing jewelry • Competitive AI backed software can provide better insights that can put Oura out of business if preventative steps are not taken
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Table 2: Strengths, Weaknesses, Opportunities, and Threats of Oura Ring

3.3.3 Marketing Mix 7P Framework

1. Product: Oura currently has 2 wellness/sleep-centric rings: a. Horizon –sleek circular design & b. Heritage –plateau design. Focus on developing sports technical feature centric product
2. Price: Currently rings cost \$330-\$650, free 1 month subscription and later \$5.99/month or \$69.99/year. Focus: Increase price of ring and provide 1-year free membership or 50% membership referral discount.
3. Place: Primary model of sales includes direct-to-consumer via webshop. In 2024, started distribution via Amazon, Target, BestBuy and Elkjøp, Focus: Expand more physical presence with fitness stores, electronics outlets and event pop-up stores.
4. Promotion: Oura currently providing promo offers to its users with other partnered brands like Headspace, Natural Cycles, and Cronometer and providing US\$40 discount upon referral. Focus: Develop communities and provide special incentives to community members and discount on membership upon referral.
5. People: Oura provides employment to over 475+ people across various countries and continents, with 20+ PhDs conducting innovative R&D in the interdisciplinary stream. Their Values: (a) Not me, we. (b) Human first. (c) Trust Matters. (d) Aim higher. (e) Find Solutions. Oura houses a team of medical advisory experts who regulate the actions on various fronts such as sleep, women's health, mental health, stress, anxiety, diseases and many more. Focus: Add expertise by working closely with sports professionals and influencers.
6. Processes: The purchasing process is simplified. The application is easy to use, with quick profile generation for personalized reports. Upon developing a profile, the user must connect the ring to the application and it's ready to use. The partner company applications are integrated in the app, which does not require exporting the data to other apps. Focus: Keep app free of bugs with special section for sports.
7. Programs: Oura is collaborating with sports institutions such as NBA, WNBA and Real Madrid to expand its reach in sports industry. Focus: Create and sponsor sports events.

3.3.4 Marketing Strategy:

The mission for Oura is to compete in the fitness wearables industry by establishing a reliable fitness-centric ring and creating the need for the product among customers. Since it is a smaller company with less awareness, many customers might be skeptical concerning the actual utility, perceived expensive price, extra membership fees, and lacking choices. Hence, by following *the Segmentation, Targeting, and Positioning (STP)* scheme (Kotler & Keller, 2016), the main aim would be to develop *a Strategic Business Unit (SBU)* that focuses on gaining trust, loyalty, and reliability. This unit can focus on more personalized marketing & increased physical presence, altering the pricing mechanism, and adding more customizability opportunities.

3.3.5 Marketing Tactics

1. Showing and proving the industry-leading sensors by expanding physical presence for people to try and feel quality/comfort.
2. Hosting or sponsoring fitness-centric events.
3. Collaborate with nutrition companies and wellness coaches to provide people with a convenient ecosystem.
4. Developing support groups and fitness communities for people to unite.
5. Penetration pricing –20% off rings and 1-year free membership, with more membership choices.
6. Customized rings for families and couples –sentimental approach.
7. Sharing real-life testimonials for potential consumers to understand its positive impact.

4 Product 3 - Garmin Watch

4.1 A Review Of The Brand History and Value Proposition

Brand History Garmin was founded in 1989 by Gary Burrell and Min Kao, initially focusing on GPS technology for aviation and marine markets (Garmin, 2024a). Over the years, Garmin expanded its product line to include automotive, outdoor, and fitness devices. Garmin used its expertise in GPS to develop highly accurate and reliable navigation systems for its products.

Market Position In 2022 Garmin had 4% of the smartwatch market, being the 5th largest competitor on the market (Counterpoint, 2022). According to its financial statement for 2023, Garmin had record revenue with an 8% increase over the revenue from 2022 (Garmin, 2023).

Value Proposition Garmin currently offers accurate, durable, and versatile fitness and outdoor activity devices tailored to serious athletes and enthusiasts who demand accurate tracking, extensive features, and reliability in harsh conditions. Garmin **segments** its market to target different user groups: professional athletes, dedicated fitness enthusiasts such as runners and cyclists who seek high-end performance devices, golf players, aviators, and motorsport practitioners (Garmin, 2024b). The **value proposition** is similar to all user groups: accuracy, reliability, and versatility. By offering different smartwatch series, such as the Forerunner series for runners, the Fenix series for multi-sport and outdoor activities, the Edge series for cyclists, and the Approach series for golf players; Garmin appeals to the different needs of its **target smartwatch market**.

Mission Statement Garmin's official mission statement is formulated as: "To be an enduring company by creating superior products for automotive, aviation, marine, outdoor, and sports that are an essential part of our customers' lives." (Garmin, 2024a)

Significant Features Differentiating Garmin Garmin differentiates itself in the fitness and smartwatches market through its navigation technology, specialized features for various activities, proven durability, long battery life, comprehensive data analysis, and broad product range (Garmin, 2024b). Garmin intends to be the brand of choice for users who prioritize performance, reliability, and detailed sport-specific metrics tracking.

Focusing on a niche market, Garmin's vulnerabilities consist of a lack of a broad ecosystem, such as the one Apple has. Also, the brand has a relatively weak retail presence compared to Apple and Samsung, and a relatively high price compared to other feature-rich smartwatches offered by Huawei and Xiaomi (Counterpoint, 2023). Customers may be satisfied with good-enough solutions and may not be enthusiastic to pay extra to get the best product.

Points of Parity & Points of Difference The points of parity of Garmin's smartwatches with the other smartwatches are GPS functionality, health and fitness tracking, smartphone connectivity, durability and build quality, and water resistance. Almost all of these features are being offered in the current industry standard competitors up to a certain level.

The points of difference are more advanced navigation features for hikers, more sports-specific tailored smartwatch series, the Garmin Connected Ecosystem, exceptional battery life, and durability in extreme conditions.

4.2 Competitive Strategy

Garmin is in competition with Apple and Oura over the market for wearable devices for sports performance and health tracking. Apple benefits from strong brand loyalty and an integrated ecosystem. Many users prefer Apple Watches due to seamless integration with other Apple devices and services, but Apple watches lack the advanced sport-specific fitness tracking functions that Garmin offers (Anderson, 2024). In terms of functionality, Oura competes with Garmin by specializing in sleep and recovery tracking, providing detailed insights that appeal to users prioritizing overall wellness rather than just fitness metrics. Moreover, Oura's ring form offers a discreet and comfortable alternative to wrist-worn devices, appealing to those who prefer minimalistic wearables (Downey, 2023).

With a history spanning 35 years (Garmin, 2024a), Garmin is a **mature company** that stably holds approximately 5% of the smartwatch market from year to year (Intelligence, 2024b). To attack Apple's leading market position and to defend against Oura, Garmin should rely on its **points of difference** and adopt a **product life cycle strategy** (Kotler & Keller, 2016) that allows for continuous innovation, **brand differentiation**, and proactive strategy adaptation to evolving market dynamics.

Leapfrogging Apple

To leapfrog Apple, Garmin has to attack Apple Watches' biggest weakness: the necessity of using the watch within the Apple ecosystem. Garmin should continuously perform **guerilla and encirclement attacks** (Kotler & Keller, 2016) with its Garmin Connect developer program (Garmin, 2024c). Garmin should focus on partnerships with large corporations and sell them smartwatches for their employees, together with an integration of Garmin Connect to the corporation's intranet. Employees would be gifted Garmin smartwatches by their employers and would be encouraged to compete with each other in terms of sports metrics over the intranet, for further rewards. As an **encirclement attack**, Garmin would distribute a large number of watches among people who would not otherwise consider themselves as smartwatch customers, who could use the "connect ecosystem" with their employers to obtain bonuses for leading an active lifestyle.

Defend Against Oura

To **defend against Oura's flank attack**, Garmin should perform a **frontal attack** on Oura by introducing a more minimalist wearable device with functions specialized for tracking sport-specific recovery. In its marketing strategy, Garmin should associate the product competing with Oura with the feeling of comfort, minimalistic sensory, and ease of use.

4.3 Marketing Plan

The fitness and smartwatch market is experiencing rapid growth driven by increasing consumer interest in health and fitness tracking, technological advancements, and lifestyle trends favoring wearable devices (Intelligence, 2024b). Garmin competes in this market alongside major players like Apple and emerging brands such as Oura. The marketing plan for Garmin aims to position the company as a leader in the fitness and smartwatch market (Garmin, 2024a), competing effectively with rivals.

4.3.1 Situation Analysis

1. Market stage and competition: Garmin has multiple competitors in the fitness wearables market. Apple dominates the market with its Apple Watch, offering a strong ecosystem, advanced health features, and brand loyalty. Oura is known for its sleek design and advanced sleep-tracking capabilities, attracting users focused on holistic well-being. Other significant competitors are Samsung, Fitbit, and Polar, each offering unique features and targeting specific market segments (Intelligence, 2024a).
2. Financial: Garmin had a record year in 2023, with a revenue of \$5.23 billion, and an 8 % increase over 2022.
3. Product: Garmin products differentiate themselves through accuracy, reliability, and durability.

4.3.2 SWOT analysis

Marketing plans typically include a SWOT analysis (Kotler & Keller, 2016), which identifies the strengths of the company, the weaknesses, the opportunities, and the threats to the company.

Strengths	Weaknesses
<ul style="list-style-type: none"> • Advanced GPS technology • Durable design • Specialized features for athletes • Loyal customer base 	<ul style="list-style-type: none"> • Limited brand recognition compared to Apple • Less intuitive user interface • Fewer recovery-related features compared to Oura
Opportunities	Threats
<ul style="list-style-type: none"> • Growing demand for fitness wearables • Expanding into emerging markets • Partnerships with health and fitness organizations 	<ul style="list-style-type: none"> • Intense competition • Rapidly changing technology • Potential disruptions in the supply chain • Regulatory challenges

Table 3: Strengths, Weaknesses, Opportunities, and Threats of Garmin

4.3.3 Marketing Mix 7P framework

The traditional marketing mix, also known as the 4P, consists of Product, Price, Place, and Promotion. The 7P's framework extends the traditional 4P's to include People, Process, and Performance, to account for the increasing complexity of modern marketing environments (Kotler & Keller, 2016). For Garmin, the marketing tactics can be based on the 7 pillars as follows:

- **Product:** Continue innovating with new product launches, focusing on advanced GPS technology, durability, and specialized features for various activities they are not yet targeting. Introduce a minimalist line of products to **defend** against a **flank attack** from Oura.
- **Pricing:** Adopt a **value-based pricing** strategy, aligning product pricing with customer-perceived value and competitive positioning. Offer tiered pricing options with various features to cater to different customer segments and budget preferences.
- **Place:** Strengthen distribution channels through **exclusive** or **selective partnerships** (Kotler & Keller, 2016) with retailers, online marketplaces, and specialty stores. Expand international presence by entering new markets and establishing strategic alliances with local distributors. Maintain the excellent track record of **partner relationship management** which will be helpful in growing the loyal customer base.
- **Promotion:** Implement **integrated, omnichannel marketing** campaigns, leveraging digital channels, and social media for high engagement with the target market segment, through influencers, and traditional advertising (Edney et al., 2018). Especially partnerships with fitness influencers, athletes, and health organizations to endorse Garmin products, keep them on **top of people's minds** and amplify **brand associations**. (Singh et al., 2008). Offering promotional incentives such as discounts, giveaways, and loyalty programs to drive customer acquisition and retention might also be an effective way (Pinto & Yagnik, 2016). As the studies of (Edney et al., 2018) and (Pinto & Yagnik, 2016) reveal, Garmin can be counted as active and effective in its social media promotion strategy so far. This strong side can be improved further and used to increase the brand value and the market presence.
- **People:** Invest in training and development programs to keep developing employees (Kotler & Keller, 2016). Grow a **customer-centric culture** focused on maintaining exceptional **brand associations** and building long-term **loyalty** with highly valuable customers (**customer lifetime value**). Create loyalty programs, frequency programs, or even exclusive club membership programs with the highest value customers.

- **Process:** Streamline internal processes to improve feedback responsiveness and customer support, particularly with Garmin Connect, to eliminate **blocking points** from its **marketing funnel**. Focus on excellent **partner relationship management (PRM)** of connected users.
- **Programs:** Garmin is already collaborating with other sport product and services companies such as Shimano, Strava, and Surfling (Garmin, 2024d). Garmin should focus on making partners with large corporate employers, such as Microsoft, Shell, and Volkswagen Group as part of its competitive strategy to **leapfrog Apple**.

4.3.4 Marketing Strategy

One of Garmin's declared strategies is to "relentlessly pursue innovation to create new products and markets that lead to growth opportunities" (Garmin, 2024a), with an official vision to "be the global leader in every market we serve". To achieve its vision of being the global leader, Garmin has to **leapfrog Apple**. Part of its marketing strategy should be aimed at performing **guerilla and encirclement attacks** on Apple's weakness, its closed ecosystem. Garmin should set up a **strategic business unit (SBU)** to partner with large corporate employers as Garmin smartwatch distributors for their employees. Garmin should aim to become the health smartwatch for the ambitious business world, to gain widespread popularity among working people who would otherwise not consider buying a sports-specific smartwatch.

4.3.5 Marketing Tactics

1. Collaborate with large corporations to distribute smartwatches to employees and throughout the business world.
2. Support corporate partners link Garmin Connect to their intranets.
3. Develop a smartwatch series aimed at business people.
4. Use social media, influencers, and advertisements to promote the image of Garmin as the watch for busy business people.
5. Develop a product aimed at extreme comfort, "wear and forget", for health tracking services that can compete with Oura's services.

5 Natural Language Processing

In this part of the project, an analysis was carried out to understand the real thoughts of customers about these three companies and their offerings. In this way, it is hoped that a meaningful comparison will be made between what companies are trying to achieve and reality. Additionally, the tangible results will help compare companies' products and brand values from the customer's perspective.

Considering the experience and routine of our team, all the coding work will be done in Python and the essential parts of the code can be seen in the Appendix for reference [A](#).

5.1 Sampling

Throughout the text mining process, the main and only data source will be Reddit for the following reasons:

- Reddit has a large number of accounts producing information that covers a large number of topics and discussions in detail, which can become a rich source for text mining.
- The subreddits help separate the subjects which are strongly related to specific topics. For this project, the specific subreddit names that are utilized are: "AppleWatch", "ouraring" and "Garmin-Watches".
- The discussions are open-sourced and anyone can access and work on them, which reduces the effort to collect all the data and lower the legal barriers.
- Reddit offers an official API to crawl and process data when registered in the developers' mode.

- Lastly, all social media platforms have different user profiles that interact in various ways. All of the text data for the mentioned 3 companies have been crawled from Reddit to keep the comparison reasonable.

However, it should be mentioned that the choice of Reddit as the sole data source has several implications:

- Reddit users might not be representing the general population or the user base of the products discussed. This could introduce bias if the daily Reddit user is significantly different from the broader users.
- Given the anonymity and the open nature of Reddit, the discussion quality can vary between subreddits and even posts. While some discussions maintain high standards, others may contain a high amount of noise or out-of-topic comments, which will affect the quality of the extracted data.
- Social media platforms especially Reddit have been used to follow news, trends, and hot topics. The crawled data might show some spikes in interest or sentiment that do not represent the long-term view of the users.
- By limiting our data pool to Reddit, we aim to get comparable data between the products. However, we might be limiting ourselves to the context of Reddit, avoiding other viewpoints on other platforms.

In summary, while Reddit provides us with a convenient and rich data source for this project, we should be careful about these limitations and take them into account while interpreting the results.

5.2 Text Mining

Data mining is the process of extracting useful information from an accumulation of data, typically from a data warehouse or a collection of linked data sets. Data mining tools include powerful statistical, mathematical, and analytical capabilities, with the primary purpose of sifting through large amounts of data to identify trends, patterns, and relationships to support informed decision-making and planning (SAP, 2024).

Text mining can be roughly defined as a knowledge-intensive process in which users interact with a collection of documents over time by using a set of analytical tools. In a similar way to data mining, text mining attempts to extract useful information from data sources by identifying and exploring patterns of interest. Of course, text mining has gained a lot of inspiration and direction from pioneering research in data mining. Therefore, text mining and data mining systems are somewhat similar (机器之心, 2024). In the case of text mining, the data source is a collection of documents, where the data is unstructured, and we need to extract information of interest from this unstructured text data.

As mentioned in the sampling part, first of all, the subreddits to crawl data have been decided. Afterward, by implementing the library 'praw' into the crawler framework, comments were successfully retrieved from the associated Apple Watch, Oura Ring, and Garmin Watch subreddits. However, the size of each dataset was quite different from each other. For example, the number of reviews for AppleWatch was more than 3 times higher than the other two. This makes a lot of sense considering Apple is the market leader and quite popular as mentioned in the first block.

Therefore, only for the Apple Watch, the parameter setting has been changed and the data has been collected from the top 500 posts excluding the "more comments" section. For the Ouraring and Garmin subreddits, the parameters were decided as 1000 top posts and 10 extended comments to reach a similar sample raw data size. By doing so, in total, the 3 datasets had 138671¹records. The subreddits help separate the subjects which are strongly related to specific topics. Again, for this project, the names of the specific subreddits that are utilized for their top posts are: "AppleWatch", "ouraring" and "Garmin-Watches".²

¹70832, 33902, 33937 for AppleWatch, ouraring, and GarminWatches respectively. It still looks uneven, but the difference does not affect the independent sentimental analysis of each company. The post dates of the comments are also unevenly distributed which will be investigated in the Temporal Dynamics chapter.

²By using `reddit.top()`, these posts are by default the posts with the highest ratings of all time. The score is calculated by the difference between the upvotes and downvotes a post has received.

5.3 Data Processing

5.3.1 Text Cleaning & Sentiment Analysis

After the raw data has been crawled, the first thing that needs to be done is cleaning the data. It includes processes such as text cleaning, word segmentation, stop word removal, part-of-speech tagging, and others. Its purpose is to convert a piece of text into a form that can be understood and processed by computers, providing a basis for subsequent processing and analysis (剪辑雄, 2023).

Semantic analysis refers to the process of in-depth understanding and interpretation of text, focusing on the meaning and expression. Just like a person may not be able to understand the meaning of each word when reading an article but can understand the relationship between sentences and the overall meaning, computers also repeat the same procedure and try to find patterns to understand the information in the text through semantic analysis. The semantic analysis uses various algorithms and models, such as word vectors, syntactic analysis, sentiment analysis, and other technologies to identify and infer entities, sentiments, relationships, and other content in the text (剪辑雄, 2023).

Text processing and semantic analysis are interrelated. Text processing provides clean and structured text data for semantic analysis, while semantic analysis further interprets and understands the meaning contained in the text. Through these two processes, computers can better process and understand our natural language.

In this project, first, the original raw data has been cleaned starting with removing the HTML tags and punctuation through the regular expressions library (import re). This ensures that only meaningful words are retained in the text to improve the cleanliness of the data. Then all text has been converted to lowercase to avoid duplicate words caused by different cases. For example, "Apple" and "apple" will be considered the same word, thereby reducing vocabulary redundancy.

Next, the stop word list in the NLTK library has been utilized to remove common meaningless high-frequency words. Stop words (such as "the", "is", etc.) appear frequently in the text, but do not contribute much to understanding the text content. Removing them can simplify the data and reduce computational complexity. At the same time, using lemma restoration technology, the words are restored to their basic form through WordNet Lemmatizer. For example, "running" is restored to "run" and "better" is restored to "good". This lemma restoration is more accurate than stemming because it takes into account the actual meaning and changes the word depending on its part in the speech, which helps to retain the semantic information of the word and improve the accuracy of subsequent analysis.

After the text cleaning is completed, The TextBlob library³ has been used to perform common sentiment analysis on the cleaned text. Sentiment polarity values range from $[-1, 1]$, with negative values indicating negative sentiment and positive values indicating positive sentiment. For example, if a review contains a word like "love", the polarity value will be higher, while if it contains a word like "hate", the polarity value will be lower. Subjectivity values range from $[0, 1]$, with values closer to 1 indicating a more subjective review and values closer to 0 indicating a more objective review. For example, a review "I think this watch is great" will be counted as highly subjective, while "This watch weighs 50 grams" will be seen as less subjective. This helps to measure the degree of subjectivity of a review and determine the proportion of personal opinions and objective statements in it.

After processing the reviews for the Apple Watch, Oura Ring, and Garmin Watches (df1, df2, df3) according to the above steps, the processed data has been saved as new CSV files⁴ for subsequent analysis.

The head of the processed data is shown as following Figure 1:

³TextBlob is a simple and easy-to-use library that can perform sentiment polarity and subjectivity analysis on text.

⁴The files "processed_applewatch_comments.csv", "processed_ouraring_comments.csv", "processed_garminwatches_comments.csv" will be attached in the zip file.

	Comment	Comment Time	Post Time	Cleaned_Comment	Polarity	Subjectivity
0	The best is getting my achievements while sitt...	2020-10-29 22:54:20	2020-10-29 22:52:32	best getting achievement sitting fat as couch	1.000000	0.300000
1	"You can still do it, take a brisk 28 minute w...	2020-10-29 23:45:50	2020-10-29 22:52:32	still take brisk 28 minute walk	0.000000	0.000000
2	"Breathe for a minute motherfucker"	2020-10-29 23:51:44	2020-10-29 22:52:32	breathe minute motherfucker	0.000000	0.000000
3	Check your rings! They're usually farther alon...	2020-10-30 00:45:32	2020-10-29 22:52:32	check ring theyre usually farther along point ...	-0.204167	0.270833
4	"Good morning, the weather is total garbage to...	2020-10-29 23:25:25	2020-10-29 22:52:32	good morning weather total garbage today gale ...	0.275510	0.526531

Figure 1: Sentiment Analysis Results

Let us first look at the frequency of the comments of 3 companies by implementing the word cloud and bar figure of the top 20 words in Figure 6, 7, 8.

5.3.2 Latent Dirichlet Allocation, LDA

The Latent Dirichlet Allocation (LDA) model is used to extract topics from user reviews of Apple Watch, Oura Ring, and Garmin Watches.

LDA is a generative probabilistic model used to discover topics from a large number of documents. The model assumes that each word in a document is generated by first extracting a topic (such as [Finance]) from the document, and then extracting a word (such as [Currency]) from the topic. The generation process of each word is independent of each other. LDA is useful because it can extract a few topics from a long document, similar to how humans label files when organizing them. This facilitates information retrieval (Misty Light, 2022). Specifically, LDA assumes the following generative process:

1. For each document, select a topic distribution.
2. For each word, select a topic from the document's topic distribution.
3. Select a word from the word distribution of the selected topic.

Through reverse inference, this process is able to infer the topic distribution of documents and the word distribution of each topic from the observed words.

Therefore, as a first step, the word frequency vectorization method is used to convert the text data into a word frequency matrix, so that the text data would be in a numerical form that can be processed by the machine learning model. Then, the LDA model is applied for topic modeling to extract potential topics in user comments.

To more intuitively show the distribution of keywords in each topic, a topic-word distribution diagram has been drawn in Figure 9, 10, 11. The figures show the first few keywords and their weights in each topic, and the results can be seen intuitively for the basic LDA model in which the parameters are the default.

When training the model, the main indicator that is checked to evaluate its effectiveness is the perplexity of the model. Perplexity is an indicator of the prediction accuracy of the language model. The lower the value, the more effective the model. By evaluating the perplexity, the performance of the LDA model under different parameter settings can be compared and the best model can be selected. Therefore, in our project, each time LDA modeling is performed, the perplexity and related parameters of the model will be returned for comparison and evaluation. The best model could be found by traversing a series of parameter combinations. Since this stage might be tedious and slow, parallel processing is used to accelerate the optimization process. Finally, the optimal parameters are selected according to the perplexity, and the best model and its parameters are utilized.⁵

As a next step, the LDA model has been optimized for the review data of Apple Watch, Oura Ring, and Garmin Watches one by one, plotting and saving the topic-word distribution graph of the best model. Through these steps, the main topics from user reviews have been successfully extracted and the keyword distribution of each topic has been visualized.

⁵For the 3, best parameters are the same: Best Params: n_topics=5, max_df=0.95, min_df=10, ngram_range=(1, 1)

After adjusting the parameters, new topic modeling was performed on each dataset and 5 main topics were extracted. The top 10 words for each topic are shown in the Appendix A. According to the results:

- **Apple Watch:** User reviews of the Apple Watch focus on several aspects. First of all, users mentioned a lot of content related to social interaction in their reviews, such as celebrating birthdays, expressing gratitude, and sharing daily life. This shows that Apple Watch is not only used as a smart device but also plays the role of a social tool to a certain extent. Secondly, users pay attention to the watch’s functions in sports and time management, such as completing sports goals and managing daily activity time. In addition, users also commented on the overall user experience and appearance design of the watch, including feedback on the performance of the watch and delight for accessories.
- **Oura Ring:** User reviews of Oura Ring reflect several major concerns. Users expressed a lot of opinions on order processing, new product releases, and the wearing experience of the ring, especially the size and comfort of the ring. In addition, users paid more attention to sleep monitoring and health data, which shows that Oura Ring has been valued by users in terms of health tracking functions. Users also expressed opinions on the subscription model and application functions of Oura Ring, looking for discounts which shows expectations and doubts about the value of subscription services and user experience.
- **Garmin Watches:** User reviews of Garmin Watches focus on sports tracking and health monitoring functions. Users discussed in detail the performance of the watch in different sports (such as running and swimming), emphasizing the importance of its sports tracking and heart rate monitoring functions. In addition, users paid attention to the wearing comfort and appearance design (such as straps and screens) of the watch. The technical specs of the watch were mostly in the foreground, especially in terms of capabilities, durability, and screen protection. Users’ emphasis on the word “charging” also reflects the key position of battery life in the user experience.

5.3.3 Bidirectional and Auto-Regressive Transformers, BART

In the previous section, the overview of comments has been reached and the products already seem to differ from each other. Now, we will cross-check this outcome by working on the same datasets and summarizing results again using the BART model offered by Hugging Face. This way, it will be possible to determine the most important values for the customer base for each product/brand. The main goal is to find the main keywords and characteristics a customer associates with these three products using two different methods.

As a powerful NLP task-processing tool, Hugging Face includes four basic Python libraries: transformers, datasets, tokenizers, and accelerate. The transformers library shares many powerful models such as BERT, GPT series models, T5, etc., and supports the use of models on both pytorch and tensorflow frameworks (奋进的 LY, 2023). The principle of automatic summary generation is based on the sequence-to-sequence (Seq2Seq) model in natural language processing, which performs well in tasks such as machine translation and text summarizing. We used the BART (Bidirectional and Auto-Regressive Transformers) model from Hugging Face’s Transformers library. BART works through an encoder-decoder architecture, where the encoder reads the input text and generates hidden representations, and the decoder generates output text from these representations. In our experiments, the sshleifer/distilbart-cnn-12-6 model is used, which is an optimized and small BART variant designed for efficient text summarization tasks.

By performing topic modeling and keyword extraction on user reviews, we obtained the following results:

- **Apple Watch:** User reviews focus on social interaction, exercise, and time management. Keywords and subject terms reflect users’ experience in daily use and social scenarios.
- **Oura Ring:** User reviews focus on order processing, subscriptions, battery kind warranty, and health data, as well as subscription services and application features. Keywords and subject terms show users’ attention to new product releases and usage experience.
- **Garmin Watches:** User reviews focus on exercise tracking, heart rate monitoring, wearing experience, appearance/design, and battery life. Keywords and subject terms are mostly about users’ feedback on the performance and durability of watches in different sports.

The results are quite similar, which encourages us to continue with the next steps.

5.4 Statistical Tests

In the previous step, the main topics from user reviews have been extracted using the LDA. Then, the outcome has been double-checked using the BART method. Now, the data - user reviews - will be further analyzed in terms of their sentiment polarity to compare user feedback between different devices.

5.4.1 General Statistics Tests

t-test Firstly, a t-test was performed to compare whether the means of the two samples were significantly different. The t-test comes in handy for this task since it can be used to determine whether there is a significant difference in the means between two groups of data. The sentiment polarity of user reviews for Apple Watch, Oura Ring, and Garmin Watches have been compared in pairs to determine whether there is a significant difference in user sentiment feedback between different devices.

As can be checked in the Code Appendix A, the outcome of this t-test shows the following result:

- Apple Watch and Oura Ring: The t-statistic is 4.923937709006354, which means that the difference between the two groups of data is significantly greater than zero, that is, the mean polarity of Apple Watch comments is significantly higher than the mean polarity of Oura Ring comments. The p-value is 8.494916836809627e-07, which is much less than 0.05, also indicating that this difference is statistically significant. This shows that users' emotional feedback on the Apple Watch is significantly better than Oura Ring.
- Apple Watch and Garmin Watches: The t-statistic is 1.422490328017742, which indicates that the mean difference between the two groups of data is not significant. The p-value is 0.15488693616526544, which is greater than 0.05, indicating that the difference is not statistically significant. This shows that there is no significant difference in users' emotional feedback on Apple Watch and Garmin Watches, and users have similar emotional polarity evaluations on the two devices.
- Oura Ring and Garmin Watches: The t-statistic is -3.2962154135149144, which means that the mean polarity of Oura Ring reviews is significantly lower than the mean polarity of Garmin Watches reviews. The p-value is 0.000980475163223708, which is much less than 0.05, indicating that this difference is statistically significant. This indicates that users' emotional feedback on Oura Ring is significantly worse than that on Garmin Watches.

In summary, when looking at the whole timeline of the data, Apple Watch seems to be the product with the highest sentiment polarity, Garmin closely follows it and Oura is far behind in the competition.

ANOVA Since the sentiment polarity of user comments between different devices has been compared through a t-test and found significant differences in user feedback, the one-way analysis of variance (ANOVA) method will be used to further verify the significance of the difference in user sentiment polarity between different devices.

One-way ANOVA is a statistical method used to compare whether there are significant differences in the means of three or more independent samples. It is based on the principle of variance decomposition, where the total variance is divided into between-group variance and within-group variance. These two metrics are compared to judge whether the means are significantly different. Specifically, ANOVA calculates an F statistic, which is the ratio of between-group variance to within-group variance. The corresponding p-value is used to judge whether the difference is statistically significant. Generally, if the p-value is less than 0.05, it is considered that there is a significant difference in the means between groups.

The obtained F-statistic is 12.619 in appendix A suggesting a high ratio of between-group variance to within-group variance. With a p-value of 3.312085870967217e-06, significantly less than 0.05, indicating that this difference is statistically significant. We therefore reject the original hypothesis that the mean values of the sentiment polarity of user reviews are the same across devices. Instead, we accept the alternative hypothesis, indicating differences in sentiment polarity mean values among at least one device. This outcome validates our previous findings from the t-test, supporting significant differences in user sentiment feedback across Apple Watch, Oura Ring, and Garmin Watches.

Chi-Square Test Next, to further understand the differences in feedback sentimentality between these devices, we use the Chi-Square Test to analyze the distribution differences in sentiment classification of the

reviews. The chi-square test - a non-parametric statistical test - calculates a chi-square statistic (Chi2), which indicates the degree of difference between the observed frequency and the expected frequency.

To be able to use the Chi-Square Test, it is necessary to convert the sentiment polarity data into sentiment classification. To keep things simple to understand, a three-level system will be used:

- When the polarity is greater than 0, the sentiment classification will be counted as "Positive",
- When the polarity is less than 0, the sentiment classification will be counted as "Negative",
- And when the polarity is equal to 0, the sentiment classification will be "Neutral".

Looking at the chi-square statistic results, the chi-square is 1174.4018129088843, indicating that the difference between the observed frequency and the expected frequency is very large. The p-value is 5.641729346523474e-253, which is much less than 0.05, showing that the difference is statistically significant. This approves the results of the ANOVA method, proving there are significant differences in the distribution of user reviews of Apple Watch, Oura Ring, and Garmin Watches in terms of sentiment classification. All the statistics are shown in the following table (Table 4):

Comparison	Statistic	p-value
t-Tests		
Apple Watch vs Oura Ring	t = 4.9239	8.4949e-07
Apple Watch vs Garmin Watches	t = 1.4225	0.1549
Oura Ring vs Garmin Watches	t = -3.2962	0.00098
ANOVA		
ANOVA F-statistic	F = 12.6191	3.3121e-06
Chi-Square Test		
Chi-Square Statistic	Chi2 = 1174.4018	5.6417e-253

Table 4: Results of Sentiment Polarity Analysis

5.4.2 Temporal Dynamics

In this part, the timeline of the comments for each product will be taken into consideration. To get a deeper understanding of the comments and posts we plotted the data from multiple perspectives and various variables. These include the Comment Time of the Monthly Average Polarity for Each Company, Monthly Comment Count for Each Company, Monthly Weighted Polarity for Each Company ⁶ as well as 3 figures for Post Time ⁷ are shown in Figure 12, 13, 14 and Figure 15, 16, 17.

Initial inspection: Looking at the first 3 figures, which focus on the highest-rated posts of all time, even though the scores of the three companies all fluctuate greatly, they are mostly positive and show a cyclical trend. For example, Apple Watch’s peaks are simply around May and October each year. This might be related to the new announcements and product versions released at the spring and autumn conferences each year. Apple Watch has been the leader from 2017 to 2019 getting significantly high scores. However, after getting the highest number of discussions in 2020, its score has been declining in terms of the number of comments and average polarity scores. Apple Watch seems to be surpassed by the other two products in the past two years. Among them, Oura Ring’s polarity score fluctuated but increased, and Garmin was able to maintain a relatively positive evaluation. Judging from the top-rated posts on Reddit, that should be noticed that Apple’s user sentiment score in the past year or so is significantly lower than the other two companies, just like its discussion heat which is also lower than the other two. The other two seem like they have been widely discussed in the past two years and have been increasing their popularity. This is just an initial look and our team will be utilizing some tests to see if they are scientifically meaningful.

Post Time vs Comment Time: We wanted to take into account the time difference between the comment time and the post time of each comment, which might affect and change the results of our analysis. For example, an older post can still be getting more comments than a new one. To understand

⁶Calculate the average polarity value for each month and multiply it by the number of reviews.

⁷Comment Time is the specific time of the reply corresponding to each comment, and Post Time is the posting time of the post to which the reply belongs to. The difference between the two can also be checked in the code appendix output.

if there is any meaningful difference between them, the z-score of each difference has been calculated and used for their skewness and kurtosis tests. The results can be seen in the appendix A. Looking at the results of Apple Watch, Oura Ring, and Garmin Watches, they all show significant left skewness and high kurtosis, especially for Apple Watch and Garmin Watches, indicating that most comments are concentrated in a short time after the post is published, while very few comments occur after a long time. This reflects the characteristics of comments on popular posts on Reddit being concentrated in the early stages of publication. As expected, the more time passes, the less attraction the post gets. Understanding there is no meaningful difference between, from now on, the comment time column will be used for the rest of the time-related comparisons.

General Statistics Tests with Time Perspective: As a next step, we will repeat the general statistic tests with the time component. In this way, we want to evaluate our findings from the time perspective and compare them with the previous results. Firstly, the t-tests for the three companies will be recalculated. The subreddits for three different products were created at different times. Therefore, the time since the last one was created will be used in the comparison. For Apple vs Oura Ring, the calculations are based on the data set starting from the earliest Comment Time of Oura Ring and the day after. For Apple vs Garmin, the calculations are based on the data set starting from the earliest Comment Time of Garmin and the day after. Ouraring vs Garmin is calculated based on the data set starting from the earliest Comment Time of Garmin and the day after. Then, ANOVA and Chi-Square Tests have been applied in order. To be able to compare the results fairly, all three data sets have been filtered starting from the earliest Comment Time of Garmin and the day after. The calculation results can be found in the related part of the code appendix A.

t-test From the t-test results, there are significant differences in the sentiment polarity of user reviews of Apple Watch and Oura Ring, with Apple Watch's sentiment polarity being significantly higher than Oura Ring's, while there is no significant difference between Apple Watch and Garmin Watches. In addition, there are also significant differences in the sentiment polarity of user reviews of Oura Ring and Garmin Watches, with Oura Ring's sentiment polarity being significantly lower than Garmin Watches.

ANOVA The ANOVA results show that there are significant differences in the sentiment polarity of user reviews of Apple Watch, Oura Ring, and Garmin Watches, indicating that at least two brands have significantly different sentiment polarities in user reviews. This means that there are significant differences in the overall sentiment feedback of users of different brands on the products.

Chi-square test Through the Chi-square test, we found that there are significant differences in the sentiment classification (positive, neutral, negative) of user reviews of Apple Watch, Oura Ring, and Garmin Watches. This shows that the distribution of user reviews of different brands in sentiment classification is significantly different, further confirming the significant differences in sentiment feedback among users of each brand.

As can be seen, the results did not show a difference when the time axis was included. They were leading to the same outcome in part 5.4.1.

Comparative Analysis of Recent Trends: We were afraid that the different foundation times of the subreddits might be leading us to misinterpreted results. This is one of the problems of choosing a sample from social media since Reddit discussions are heavily influenced by new events and trends. The data might spike temporarily in favor of one of the brands, leading to wrongly interpreted long-term results. Therefore, We went a step further and examined only the data from nearly the past two years, that is, starting from **September 8, 2022**, when the Apple Watch Series 8 was released, to the present. The details can be found in the code appendix A.

User review data from **September 8, 2022** to present shows that there are significant differences in the emotional polarity between Apple Watch and Oura Ring, and between Apple Watch and Garmin Watches, with Apple Watch's emotional polarity being significantly lower than the other two brands. However, there is no significant difference in the emotional polarity between Oura Ring and Garmin Watches. At the same time, the results of ANOVA and Chi-square tests show that there are significant differences in the emotional polarity and emotional classification of user reviews of different brands, reflecting the significant differences in user emotional feedback between brands.

Compared with the earlier full-timeline data, data from the past two years (starting from September 8, 2022) further emphasizes the significant differences in user emotional polarity of Apple Watch, especially when compared with Garmin Watches. Although previous data showed no significant difference between Apple Watch and Garmin Watches, this difference has become significant in the past two years. Overall, this may reflect the impact of Apple Watch on recent product launches and market strategies, resulting in changes in its user emotional feedback relative to other brands.

All of the statistics calculated in the Temporal Dynamics part are shown in the Table 5:

Comparison	Statistic	p-value
t-Tests (Full time for the shorter range)		
Apple Watch vs Oura Ring	t = 5.3005	1.1574e-07
Apple Watch vs Garmin Watches	t = -0.8837	0.3768
Oura Ring vs Garmin Watches	t = -4.1297	3.6364e-05
ANOVA (Full time for the shortest range)		
ANOVA F-statistic	F = 8.4283	0.0002187
Chi-Square Test (Full time for the shortest range)		
Chi-Square Statistic	Chi2 = 787.0404	4.9252e-169
t-Tests (since Sept 8, 2022)		
Apple Watch vs Oura Ring	t = -4.2338	2.3037e-05
Apple Watch vs Garmin Watches	t = -6.1667	7.0333e-10
Oura Ring vs Garmin Watches	t = -1.7842	0.0744
ANOVA (since Sept 8, 2022)		
ANOVA F-statistic	F = 19.5743	3.1737e-09
Chi-Square Test (since Sept 8, 2022)		
Chi-Square Statistic	Chi2 = 403.9167	3.9628e-86

Table 5: Results of Sentiment Polarity Analysis with Timeline

5.5 Conclusion

From the previous analysis in this chapter, it can be seen that the comments of the three companies have different focuses on sentiment analysis, and the comments on Reddit reflect different orientations. Apple Watch user reviews focus on social interaction, sports, time management, and other aspects mainly around the user’s experience in daily use and social scenarios. Oura Ring’s user reviews focus on order processing, subscription services, warranties, and health data, related to new product launches and experiences while using it. User reviews of Garmin watches focus on movement tracking, heart rate monitoring, wear experience, design, and battery life, and are mostly feedback from users on the performance and durability of the watch in different sports.

Regarding the sentiment polarity data test, looking at the entire timeline, the evaluations of the three companies were not the same. Comparing them two by two, the Apple Watch’s score was slightly better than the Garmin Watch, but both are significantly better than the Oura Ring. The same conclusion is reached for the relatively shorter timelines (depending on the shorter range). However, when we specifically focused on the comments in the past two years (September 8, 2022 to the present), the conclusions were very different from before. By examining Figure 12, some trends have been discovered, and then through applying t-tests and further tests, the results confirmed our observations. The user evaluations of Apple Watch in the last two years were significantly inferior when compared with the other two products. Garmin watches have become the most successful product from the user’s perspective. Moreover, it can be seen from Figure 13, that the user review amount of Apple has also declined in the past two years. Meanwhile, the popularity(number and the sentimental polarity of the comments) of Garmin Watch and Oura Ring was increasing rapidly.

6 Marketing Campaign Strategy

6.1 Apple Watch

6.1.1 Problems & Vulnerabilities

As analyzed in the Block 2 results, although Apple Watch still has the largest sales, is getting left behind in terms of the amount of new user reviews, engagement, and polarity score. Apple needs to be extremely careful and must defend itself from being leapfrogged. To do this, Apple needs to reinforce its brand loyalty and community engagement through multiple channels and platforms. The next campaign should focus on gaining traction and confirming its distinct value proposition through product differentiation. An example could be to start a fitness campaign that rewards participants. After that, at the climax when the campaign is getting the most attention, Apple announces a new product cycle that addresses the previous generation's weak points. Apple Watch's weaknesses (explained in detail in Section 1) are mainly its high entry price, relatively short battery life, incompatibility with other operating systems, and its dependency on the iPhone. The new marketing campaign should address these problems except for the compatibility with other systems because it contradicts the inclusive ecosystem benefits Apple has built over the years. The fitness campaign plus the timely release of the product will create a resonance effect in the market, renewing user interest, and solidifying the brand position.

6.1.2 Visualized Campaign

Based on the product release cycle, the Apple Watch line is usually released in the fall season of a calendar year (around September or October). Hence, the marketing campaign must be launched at least 6 months in advance to create the optimum hype for the new products. Therefore, the proposed marketing plan has a duration of 6 months from the beginning of the year.

The campaign is divided into 4 phases:

- **Phase 1 - Campaign Launch:** The campaign will start with a rumor about new innovative features that have not been developed by other competitors. The "newly projected" feature will create fresh hype even before the product appears on the market. The features can include improved battery life or new advanced tracking sensors for fitness or healthcare. This information should be somewhat backed up by a secondary source such as an announcement from the supply chain partners. For example, in the past, new features such as a high-refresh-rate screen, advanced cameras, and Face ID are almost accurately predicted by the community through announced changes in the production and assembly companies. This phase will serve as the baseline for creating hype within the community.
- **Phase 2 - Engagement:** As we discovered in the sentimental analysis in part 2, Apple Watch is more than hardware. It is a socializing item representing a certain lifestyle. In correlation, a global fitness challenge exclusive to Apple Watch's users can be established. In this challenge, participants can track their workout and fitness records with their Apple Watch. The challenges can take many forms, such as achieving 100,000 steps per month or completing a virtual marathon at your own pace to get an exclusive, shareable badge. In addition, users should be encouraged to share their results on social media platforms for 2 main purposes. First is to spread the challenge on a broader scale, and second is to mask the campaign as a healthy, trendy lifestyle that fits its target audience.
- **Phase 3 - Community Building & Loyalty Rewards:** After a particular milestone, they can receive a coupon/discount for the next-generation Apple Watch product or Apple services as a gift, such as 1 month free of Apple Music. Apple has a diverse range of complementary services that can be offered to participants with exclusive features to improve their health and, most importantly, to do it with their friend circle. Doing the challenges in a group can earn them extra points. Using the services as a mediator, community engagement can be established which leads to attracting new users into the ecosystem.
- **Phase 4 - Innovation Confirmation & Leveraging Influencing Voices:** In this phase, Apple will hold a convention, in which they will confirm some of the previous rumors about new exclusive features. Live, interactive demonstration is what ensures a total buy-in from customers with real-world scenarios to show practical benefits. In addition, strategic partnerships with influential voices in the tech communities will further this buy-in. By giving the tech, gadget reviewers early access to the product, they can create detailed reviews and tutorial content, which they can share across YouTube, Instagram, TikTok, and other social media platforms. Collaborating with lifestyle

influencers is also beneficial because they can show how Apple Watch integrates with their regular fitness routines, attracting customers who are interested in a fashionable outlook.



Figure 2: Apple Campaign Timeline

6.1.3 Communication

The key message in this campaign for the market is Apple Watch is a reliable product. It plays a vital role in providing a healthier lifestyle and, in many cases, possibly saving lives with its monitoring technology. In the marketing campaign, the message should be conveyed using real-life success stories for a deeper impact on the crowds, like the 911 ads video, which received many compliments (Asia, 2023).

6.2 Oura Ring

In block 1, we formulated the marketing tactics by learning from the business model, and in block 2 we observed that sentimental polarity is exponentially growing (See Monthly weighted polarity Figure 14) showcasing its familiarity and steady progress. To tap the potential, we suggest the following steps.

6.2.1 Rebranding

Currently, Oura's utility as both a sleep-tracking device and a fitness supplement device is still confusing for users. Hence, it is important to simplify the message and divert the focus to one area. As part of a rebranding, Oura can form a *strategic business unit (SBU) as 'OuraPeak'*, with a brand association of a fitness-centric ring with a slogan of: *"Track Improve Breathe Peak"*.

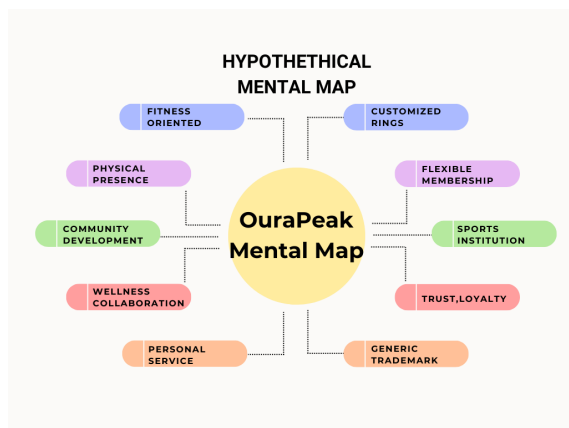


Figure 3: OuraPeak Hypothetical Mental Map

Brand Launch Campaign - OuraPeak

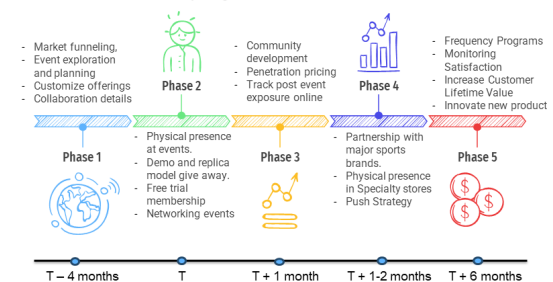


Figure 4: OuraPeak Campaign Timeline

6.2.2 Brand Launch Campaign

- **Phase 1:** Market analysis and funneling potential target customers based on age, gender, workout, devices they currently use, and types of events they mostly attend, product conversion rates, and understand their plights. Customize the rings and membership for fitness.
- **Phase 2 - Multi-Stage Marketing Process:** Collaborate with sports events like marathons, triathlons, survival runs, hellrunners, etc.
 - a. ‘OuraPeak’ pop-up stores during the events, where people can feel/try the product, understand comfort, utility, and customizability, and compare their devices.- *Sensory Marketing*
 - b. Give out demo rings by charging a deposit and convince them to use them during their race. Collect rings at the end of the race and give participants a detailed analysis of their performance.
 - c. As a goodie, give out replica rings for people to use as jewelry, that might convince them over time how comfortable it feels and how elegant it looks.
 - d. In collaboration with partners like Headspace, give out trial memberships to registered participants when they arrive at the booth. They can combine their race data on the app with other apps like meditation/sleep, and get recommendations for maximum recovery. This helps in two ways: i. The company understands consumer pain points; ii. Allows people to use the digital product in their peaceful time to understand the product’s use in their lives.
 - e. Post-race networking events for fellow participants.
- **Phase 3 - Penetration Pricing:** Offer a 20% discount on rings and a 1-year free Oura membership for the first 500 participants. Also, partner with similar sports communities like marathon runners, workout buddies and provide incentives for members of that community. Similarly, partner with corporate companies who have participated in the race to give their members incentives.
- **Phase 4 - Push Strategy:** Partner with sports companies like Nike and UnderArmour to set up small pop-ups in their stores for sports enthusiasts to check out the product, and provide similar free replicas/goodies whenever someone buys a particular product like a shoe from a sports store. This expands outreach to the targeted population.
- **Phase 5 - Frequency Programs:** Build loyalty/trust with important customers with these programs. Constantly monitor satisfaction among them and focus on increasing *Customer lifetime value (CLV)* by providing value-added services and upgrade bonuses.
 - Focus on innovating new products catered to changing consumer needs.

6.3 Garmin Watch

Strength and Opportunity

Section 5 revealed that Garmin user reviews focus on the technical and hardware aspects of the products. The technical capabilities, battery performance, and durability. Garmin has a strong stable brand image around sports and having an active lifestyle, and, in accordance to its financial statements for 2023 (Garmin, 2023), it is growing in popularity in the online environment, see fig. 13.

The large number of recent positive discussions about Garmin, see fig. 12 shows that it is currently on top of the minds of its users, and the products are getting a lot of attention. Garmin should use this current peak of popularity to consolidate its user community and perform an **encirclement attack** on the Apple Watch. Because section 4 identified an opportunity for Garmin to promote itself as the health smartwatch for the business environment through Garmin Connect, the marketing campaign should also be aimed at establishing partnerships with large corporations.

Marketing Campaign Strategy

As Garmin’s users are focused on the engineering quality of the products, Garmin could openly release their Garmin Connect API (Garmin, 2024c) to all users, not only to enterprises. Moreover, Garmin should establish new partnerships with corporations, to distribute smartwatches in the business environment. The primary goal of the campaign would be to create and penetrate the market for business smartwatches. The secondary goal would be to attract users from the Apple Watch who are not fully satisfied with its closed ecosystem. The tertiary goal of the marketing campaign would be to consolidate its community around smartwatches by allowing people to freely program and share applications for them.

The campaign could be divided into 7 phases over approximately 16 months:

1. **Planning and research (2 months):** Analyze the corporate health and productivity market, identify the needs and wants of business professionals, and understand the dissatisfaction points of Apple Watch users. Segment the target audience into business people, current Garmin users, and people who would switch from using Apple Watch.
2. **Strategy development (2 months):** Develop advertisements that highlights Garmin's benefits for business professionals, examples can be long-term productivity, health, and integration with corporate intranet systems. Highlight the open-source development possibilities and potential for innovation with Garmin's API. Emphasize the contrast with Apple's closed ecosystem.
3. **Content creation (2 months):** Produce tutorials, demo videos, and highlight the possibilities that Apple Watch users miss. The imagery should reflect a professional and business-oriented brand image.
4. **Execution (6 months):** Pre-launch event with demonstrations; post-launch advertising and webinars to help users learn the API.
5. **Optimization (2 months):** Track engagement metrics, API usage rates, and conversion rates from users. Refine the messaging and targeting based on performance data.
6. **Evaluation and reporting (2 months):** Evaluate the campaign's success by measuring penetration into the business smartwatch market, Garmin Connect API usage, and new watch sales. Focus on collecting feedback from new users. Especially people from the business world, to understand their experiences. Compile a report with recommendations for future campaigns.
7. **Post campaign (upcoming times):** Maintain support of API users, and encourage further open-source development through student competitions.

The timeline, starting from the present time, is shown in fig. 5.

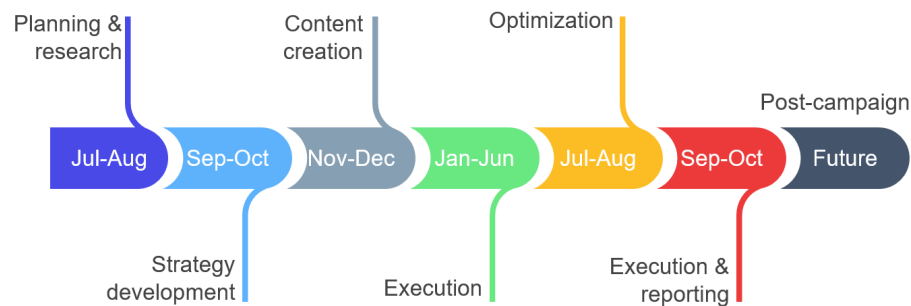


Figure 5: Garmin Campaign Timeline

This marketing strategy aims to penetrate the market for business watches, attack Apple's closed ecosystem, and build a community around the business world that would not otherwise be attracted by a sports-oriented smartwatch.

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A Code Appendix

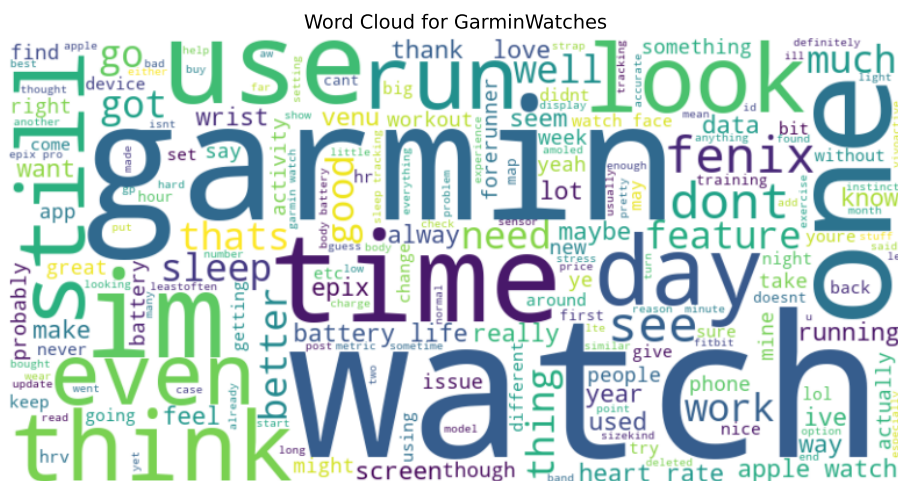
```
1 % This for the timeline analysis datasets
2 import praw
3 import csv
4 from tqdm import tqdm
5 from datetime import datetime
6 import time
7
8 def get_top_comments(subreddit_name, num_posts=10, limit_comments=0):
9
10     subreddit = reddit.subreddit(subreddit_name)
11     top_posts = subreddit.top(limit=num_posts)
12
13     all_comments = []
14
15     for post in tqdm(top_posts, desc=f"Processing posts in {subreddit_name}", unit="post"):
16         post_time = datetime.fromtimestamp(post.created_utc)
17
18         success = False
19         while not success:
20             try:
21                 post.comments.replace_more(limit=limit_comments)
22                 success = True
23             except praw.exceptions.RedditAPIException as e:
24                 if 'RATELIMIT' in str(e):
25                     print(f"Rate limit exceeded, sleeping for 60 seconds...")
26                     time.sleep(60)
27                 else:
28                     raise e
29
30         for comment in tqdm(post.comments.list(), desc=f"Processing comments in post {post.id}", unit="comment", leave=False):
31             comment_time = datetime.fromtimestamp(comment.created_utc)
32             all_comments.append((comment.body, comment_time, post_time))
33
34     return all_comments
35
36 def save_comments_to_csv(comments, filename):
37     with open(filename, 'w', newline='', encoding='utf-8-sig') as file:
38         writer = csv.writer(file)
39         writer.writerow(['Comment', 'Comment Time', 'Post Time'])
40         for comment, comment_time, post_time in comments:
41             writer.writerow([comment, comment_time, post_time])
42
43 if __name__ == "__main__":
44     subreddits = {
45         'AppleWatch': 'applewatch_comments4.csv',
46         'GarminWatches': 'garminwatches_comments4.csv',
47         'ouraring': 'ouraring_comments4.csv'
48     }
49
50     for subreddit, filename in subreddits.items():
51         if subreddit == 'AppleWatch':
52             num_posts = 500
53             lim = 0
54         else:
55             num_posts = 1000
56             lim = 10
57         comments = get_top_comments(subreddit, num_posts)
58         save_comments_to_csv(comments, filename)
59         print(f"Comments saved to {filename}")
```

```
Processing posts in AppleWatch: 500post [08:55, 1.07s/post]
Comments saved to applewatch_comments4.csv
Processing posts in GarminWatches: 1000post [14:59, 1.11post/s]
Comments saved to garminwatches_comments4.csv
Processing posts in ouraring: 1000post [14:49, 1.12post/s]
```


Comments saved to ouraring_comments4.csv

```
1 import re
2 import nltk
3 from nltk.corpus import stopwords
4 from nltk.stem import WordNetLemmatizer
5 from textblob import TextBlob
6
7 nltk.download('stopwords')
8 nltk.download('wordnet')
9
10 # Text cleaning functions
11 def clean_text(text):
12     text = re.sub(r'<.*?>', '', text) # Remove HTML tags
13     text = text.lower()
14     text = re.sub(r'~\w\s]', '', text) # Remove punctuation
15     stop_words = set(stopwords.words('english'))
16     words = text.split()
17     words = [word for word in words if word not in stop_words] # Remove stop words
18     lemmatizer = WordNetLemmatizer()
19     words = [lemmatizer.lemmatize(word) for word in words] # Stemming
20     return ' '.join(words)
21
22 # Sentiment analysis functions
23 def analyze_sentiment(text):
24     analysis = TextBlob(text)
25     return analysis.sentiment.polarity, analysis.sentiment.subjectivity
26
27 # Processing DataFrame
28 def process_dataframe(df):
29     df['Cleaned_Comment'] = df['Comment'].apply(clean_text)
30     df[['Polarity', 'Subjectivity']] = df['Cleaned_Comment'].apply(lambda x: pd.Series(
31         analyze_sentiment(x)))
32
33     return df
34
35 # Reading CSV Files
36 df1 = pd.read_csv('applewatch_comments.csv')
37 df2 = pd.read_csv('ouraring_comments3.csv')
38 df3 = pd.read_csv('garminwatches_comments3.csv')
39
40 # Perform text cleaning and sentiment analysis on DataFrame
41 df1 = process_dataframe(df1)
42 df2 = process_dataframe(df2)
43 df3 = process_dataframe(df3)
44
45 # Save the processed DataFrame to a new CSV file
46 df1.to_csv('processed_applewatch_comments.csv', index=False, encoding='utf-8-sig')
47 df2.to_csv('processed_ouraring_comments.csv', index=False, encoding='utf-8-sig')
48 df3.to_csv('processed_garminwatches_comments.csv', index=False, encoding='utf-8-sig')
```

```
1 from sklearn.feature_extraction.text import CountVectorizer
2 from sklearn.decomposition import LatentDirichletAllocation
3 import matplotlib.pyplot as plt
4 import numpy as np
5 from joblib import Parallel, delayed
6
7 # Read the processed CSV file
8 df1 = pd.read_csv('processed_applewatch_comments.csv')
9 df2 = pd.read_csv('processed_ouraring_comments.csv')
10 df3 = pd.read_csv('processed_garminwatches_comments.csv')
11
12 df1['Cleaned_Comment'] = df1['Cleaned_Comment'].fillna('')
13 df2['Cleaned_Comment'] = df2['Cleaned_Comment'].fillna('')
14 df3['Cleaned_Comment'] = df3['Cleaned_Comment'].fillna('')
15
16 def generate_wordcloud(text, title, filename):
17     wordcloud = WordCloud(width=800, height=400, background_color='white').generate(text)
18     plt.figure(figsize=(10, 5))
19     plt.imshow(wordcloud, interpolation='bilinear')
20     plt.axis('off')
21     plt.title(title)
22     plt.savefig(f'{filename}.pdf', format='pdf')
23     plt.show()
```

```

1 # basic LDA model
2 def display_topics(model, feature_names, no_top_words):
3     for topic_idx, topic in enumerate(model.components_):
4         print("Topic %d:" % (topic_idx))
5         print(" ".join([feature_names[i] for i in topic.argsort()[::-no_top_words - 1:-1]]))
6
7 def lda_topic_modeling(df, n_topics=5, no_top_words=10):
8
9     vectorizer = CountVectorizer(max_df=0.95, min_df=2, stop_words='english')
10    dtm = vectorizer.fit_transform(df['Cleaned_Comment'].astype(str))
11
12    lda = LatentDirichletAllocation(n_components=n_topics, random_state=0)
13    lda.fit(dtm)
14
15    display_topics(lda, vectorizer.get_feature_names_out(), no_top_words)
16
17    return lda, vectorizer
18
19 print("AppleWatch Topics:")
20 lda_applewatch, vectorizer_applewatch = lda_topic_modeling(df1)
21 print("\nOuraring Topics:")
22 lda_ouraring, vectorizer_ouraring = lda_topic_modeling(df2)
23 print("\nGarminWatches Topics:")
24 lda_garminwatches, vectorizer_garminwatches = lda_topic_modeling(df3)
25
26 def plot_top_words(model, feature_names, n_top_words, title):
27     fig, axes = plt.subplots(2, 3, figsize=(15, 10), sharex=True)
28     axes = axes.flatten()
29     for topic_idx, topic in enumerate(model.components_):
30         top_features_ind = topic.argsort()[::-n_top_words - 1:-1]
31         top_features = [feature_names[i] for i in top_features_ind]
32         weights = topic[top_features_ind]
33
34         ax = axes[topic_idx]
35         ax.barh(top_features, weights, color='blue')
36         ax.set_title(f'Topic {topic_idx + 1}',
37                     fontdict={'fontsize': 15})
38         ax.invert_yaxis()
39         ax.tick_params(axis='both', which='major', labelsize=12)
40         for i in 'top right left'.split():
41             ax.spines[i].set_visible(False)
42         fig.suptitle(title, fontsize=20)
43
44 plt.subplots_adjust(top=0.90, hspace=0.3)
45 plt.show()

```

```

46 plot_top_words(lda_applewatch, vectorizer_applewatch.get_feature_names_out(), 10, 'Top
47 words per topic in AppleWatch')
48 plot_top_words(lda_ouraring, vectorizer_ouraring.get_feature_names_out(), 10, 'Top words
49 per topic in OuraRing')
plot_top_words(lda_garminwatches, vectorizer_garminwatches.get_feature_names_out(), 10, '
Top words per topic in GarminWatches')

```

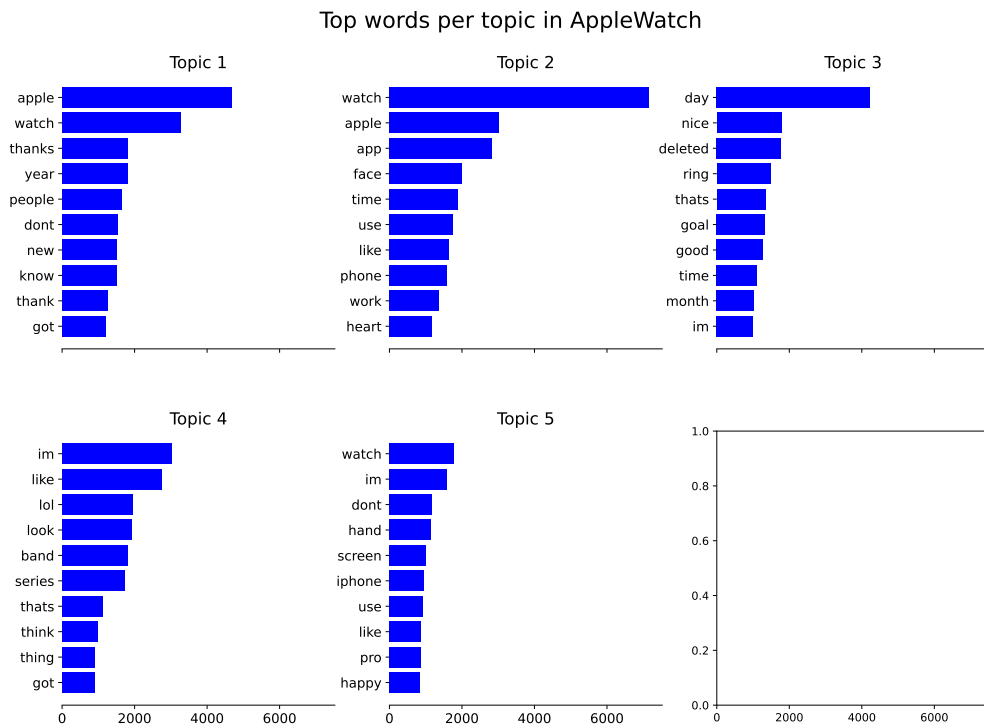


Figure 9: Best AppleWatch topics

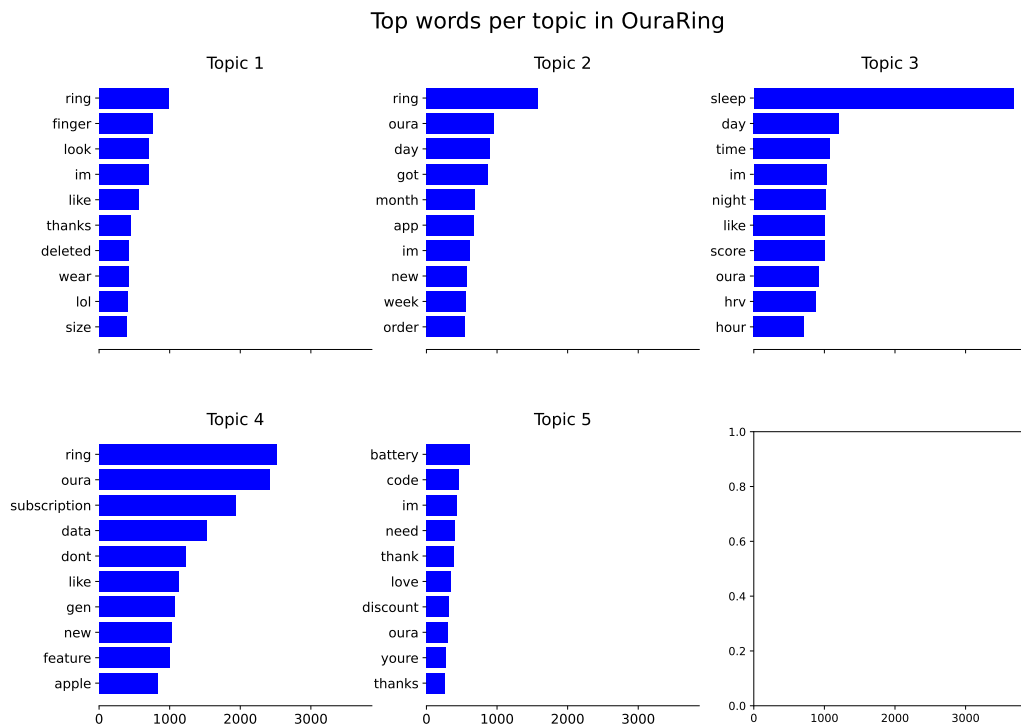


Figure 10: Best OuraRing topics

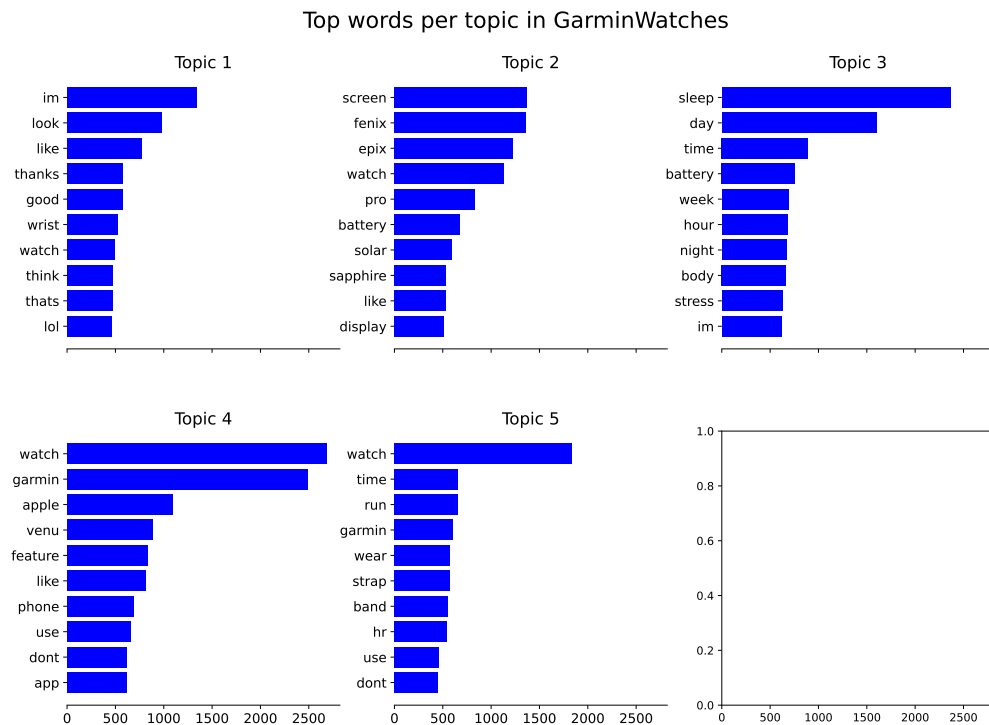


Figure 11: Best GarminWatches topics

```
1 def display_topics(model, feature_names, no_top_words):
```

```

2     for topic_idx, topic in enumerate(model.components_):
3         print("Topic %d:" % (topic_idx))
4         print(" ".join([feature_names[i] for i in topic.argsort()[::-no_top_words - 1:-1]])
5                        )
6
7 def lda_topic_modeling(df, n_topics=5, no_top_words=10, max_df=0.95, min_df=2, ngram_range
8                        =(1,1)):
9     vectorizer = CountVectorizer(max_df=max_df, min_df=min_df, stop_words='english',
10                                ngram_range=ngram_range)
11     dtm = vectorizer.fit_transform(df['Cleaned_Comment'].astype(str))
12     lda = LatentDirichletAllocation(n_components=n_topics, random_state=0)
13     lda.fit(dtm)
14     display_topics(lda, vectorizer.get_feature_names_out(), no_top_words)
15     return lda, vectorizer, dtm
16
17 def plot_top_words(model, feature_names, n_top_words, title, filename):
18     fig, axes = plt.subplots(2, 3, figsize=(15, 10), sharex=True)
19     axes = axes.flatten()
20     for topic_idx, topic in enumerate(model.components_):
21         top_features_ind = topic.argsort()[::-n_top_words - 1:-1]
22         top_features = [feature_names[i] for i in top_features_ind]
23         weights = topic[top_features_ind]
24         ax = axes[topic_idx]
25         ax.barh(top_features, weights, color='blue')
26         ax.set_title(f'Topic {topic_idx + 1}', fontdict={'fontsize': 15})
27         ax.invert_yaxis()
28         ax.tick_params(axis='both', which='major', labelsize=12)
29         for i in 'top right left'.split():
30             ax.spines[i].set_visible(False)
31         fig.suptitle(title, fontsize=20)
32     plt.subplots_adjust(top=0.90, hspace=0.3)
33     plt.savefig(filename, format='pdf')
34     plt.show()
35
36 def evaluate_lda_model(lda, dtm):
37     perplexity = lda.perplexity(dtm)
38     return perplexity
39
40 def single_optimization_run(df, n_topics, max_df, min_df, ngram):
41     lda, vectorizer, dtm = lda_topic_modeling(df, n_topics=n_topics, max_df=max_df, min_df
42                                               =min_df, ngram_range=ngram)
43     perplexity = evaluate_lda_model(lda, dtm)
44     return perplexity, lda, vectorizer, dtm, (n_topics, max_df, min_df, ngram)
45
46 def optimize_lda(df, n_topics_range, max_df_range, min_df_range, ngram_range):
47     best_perplexity = float('inf')
48     best_params = None
49     best_lda = None
50     best_vectorizer = None
51     best_dtm = None
52
53     results = Parallel(n_jobs=-1)(
54         delayed(single_optimization_run)(df, n_topics, max_df, min_df, ngram)
55         for n_topics in n_topics_range
56         for max_df in max_df_range
57         for min_df in min_df_range
58         for ngram in ngram_range
59     )
60
61     for perplexity, lda, vectorizer, dtm, params in results:
62         if perplexity < best_perplexity:
63             best_perplexity = perplexity
64             best_params = params
65             best_lda = lda
66             best_vectorizer = vectorizer
67             best_dtm = dtm
68
69     print(f'Best Params: n_topics={best_params[0]}, max_df={best_params[1]}, min_df={
70           best_params[2]}, ngram_range={
71           best_params[3]}')
72
73     return best_lda, best_vectorizer, best_dtm, best_params
74
75 # Parameter range

```

```

69 n_topics_range = [5, 10, 15]
70 max_df_range = [0.95, 0.90, 0.85]
71 min_df_range = [2, 5, 10]
72 ngram_range = [(1, 1), (1, 2)]
73
74 # Optimizing the LDA model
75 print("Optimizing for AppleWatch")
76 best_lda_applewatch, best_vectorizer_applewatch, best_dtm_applewatch,
    best_params_applewatch = optimize_lda(df1,
    n_topics_range, max_df_range,
    min_df_range, ngram_range)
77
78 print("Optimizing for OuraRing")
79 best_lda_ouraring, best_vectorizer_ouraring, best_dtm_ouraring, best_params_ouraring =
    optimize_lda(df2, n_topics_range,
    max_df_range, min_df_range, ngram_range)
80
81 print("Optimizing for GarminWatches")
82 best_lda_garminwatches, best_vectorizer_garminwatches, best_dtm_garminwatches,
    best_params_garminwatches = optimize_lda(
    df3, n_topics_range, max_df_range,
    min_df_range, ngram_range)

```

Optimizing for AppleWatch

Best Params: n_topics=5, max_df=0.95, min_df=10, ngram_range=(1, 1)

Optimizing for OuraRing

Best Params: n_topics=5, max_df=0.95, min_df=10, ngram_range=(1, 1)

Optimizing for GarminWatches

Best Params: n_topics=5, max_df=0.95, min_df=10, ngram_range=(1, 1)

```

1 # based on the parameters from the last block outcomes:
2 def lda_topic_modeling(df, n_topics=5, no_top_words=10, max_df=0.95, min_df=10,
    ngram_range=(1,1)):
3     vectorizer = CountVectorizer(max_df=max_df, min_df=min_df, stop_words='english',
    ngram_range=ngram_range)
4     dtm = vectorizer.fit_transform(df['Cleaned_Comment'].astype(str))
5
6     lda = LatentDirichletAllocation(n_components=n_topics, random_state=0)
7     lda.fit(dtm)
8
9     def display_topics(model, feature_names, no_top_words):
10         for topic_idx, topic in enumerate(model.components_):
11             print("Topic %d:" % (topic_idx))
12             print(" ".join([feature_names[i] for i in topic.argsort()[::-no_top_words - 1:-
13                             1]]))
14
15     display_topics(lda, vectorizer.get_feature_names_out(), no_top_words)
16
17     return lda, vectorizer, dtm
18
19 print("AppleWatch Topics:")
20 lda_applewatch, vectorizer_applewatch, dtm_applewatch = lda_topic_modeling(df1, n_topics=5
    )
21
22 print("\nOuraRing Topics:")
23 lda_ouraring, vectorizer_ouraring, dtm_ouraring = lda_topic_modeling(df2, n_topics=5)
24
25 print("\nGarminWatches Topics:")
26 lda_garminwatches, vectorizer_garminwatches, dtm_garminwatches = lda_topic_modeling(df3,
    n_topics=5)

```

AppleWatch Topics:

Topic 0:

apple watch year thanks people omg bro love congrats birthday

Topic 1:

watch apple app face time use phone like work heart

Topic 2:

day nice deleted ring thats goal good time month im

Topic 3:

im like lol look series band thats think thing time

Topic 4:

im watch hand dont screen iphone happy pro like use

OuraRing Topics:

Topic 0:

sleep day im time night hrv score like ive hour

Topic 1:

like oura size finger dont people im think good make

Topic 2:

thanks code im thank link discount looking got post love

Topic 3:

ring oura data watch app feature thing subscription use wear

Topic 4:

ring new gen oura battery month year day customer got

GarminWatches Topics:

Topic 0:

watch wrist band strap wear dont like look thank big

Topic 1:

year garmin im watch got thanks venu new lol good

Topic 2:

sleep day time im like run swim body training night

Topic 3:

watch garmin apple use like feature phone dont app data

Topic 4:

epix screen fenix sapphire battery look pro charging life face

```
1 import torch
2 print(torch.__version__)
3
4 # Function to generate summaries for each company's comments
5 from transformers import pipeline
6
7 # Function to generate summaries for each company's comments
8 def generate_summary(df, device):
9     summarizer = pipeline('summarization', model="sshleifer/distilbart-cnn-12-6", device=
10                          device)
11     summaries = summarizer(df['Cleaned_Comment'].iloc[:10].str.cat(sep=' '), max_length=50
12                          , min_length=25, do_sample=False)
13     return summaries
14
15 # Check if GPU is available and set the device
16 device = 0 if torch.cuda.is_available() else -1
17
18 # Generate summaries for each company
19 summary1 = generate_summary(df1, device)
20 summary2 = generate_summary(df2, device)
21 summary3 = generate_summary(df3, device)
22
23 print("Summary for Apple Watch:")
24 print(summary1)
25 print("Summary for Oura Ring:")
26 print(summary2)
27 print("Summary for Garmin Watches:")
28 print(summary3)
```

1.11.0+cu113

Downloading: 100%| | 1.76k/1.76k [00:00<00:00, 1.80MB/s]

Downloading: 100%| | 1.14G/1.14G [01:48<00:00, 11.2MB/s]

Downloading: 100%| | 26.0/26.0 [00:00<00:00, 25.9kB/s]

Downloading: 100%| | 878k/878k [00:00<00:00, 2.54MB/s]

Downloading: 100%| | 446k/446k [00:00<00:00, 1.88MB/s]

Summary for Apple Watch:

[{'summary_text': ' Good morning weather total garbage today gale force wind rain rain low temperat

Summary for Oura Ring:

```
[{'summary_text': ' Im gonna upgrade next gen simply ring simply ring still new work long time comp
```

Summary for Garmin Watches:

```
[{'summary_text': ' Drop drinking since new year still want enjoy focus on exercise tracking find g
```

```
1 from scipy import stats
2 def perform_t_test(df1, df2):
3     t_stat, p_val = stats.ttest_ind(df1['Polarity'], df2['Polarity'])
4     return t_stat, p_val
5
6 # AppleWatch vs OuraRing
7 t_stat, p_val = perform_t_test(df1, df2)
8 print(f'AppleWatch vs OuraRing: t_stat={t_stat}, p_val={p_val}')
9
10 # AppleWatch vs GarminWatches
11 t_stat, p_val = perform_t_test(df1, df3)
12 print(f'AppleWatch vs GarminWatches: t_stat={t_stat}, p_val={p_val}')
13
14 # OuraRing vs GarminWatches
15 t_stat, p_val = perform_t_test(df2, df3)
16 print(f'OuraRing vs GarminWatches: t_stat={t_stat}, p_val={p_val}')
```

AppleWatch vs OuraRing: t_stat=4.923937709006354, p_val=8.494916836809627e-07

AppleWatch vs GarminWatches: t_stat=1.422490328017742, p_val=0.15488693616526544

OuraRing vs GarminWatches: t_stat=-3.2962154135149144, p_val=0.000980475163223708

```
1 from scipy.stats import f_oneway
2
3 appletwatch_polarity = df1['Polarity']
4 ouraring_polarity = df2['Polarity']
5 garminwatches_polarity = df3['Polarity']
6
7 f_stat, p_val = f_oneway(appletwatch_polarity, ouraring_polarity, garminwatches_polarity)
8 print(f'ANOVA: F_stat={f_stat}, p_val={p_val}')
```

ANOVA: F_stat=12.619084881979134, p_val=3.312085870967217e-06

```
1 from scipy.stats import chi2_contingency
2
3 df1['Sentiment'] = df1['Polarity'].apply(lambda x: 'Positive' if x > 0 else ('Negative' if
                                                                           x < 0 else 'Neutral'))
4 df2['Sentiment'] = df2['Polarity'].apply(lambda x: 'Positive' if x > 0 else ('Negative' if
                                                                           x < 0 else 'Neutral'))
5 df3['Sentiment'] = df3['Polarity'].apply(lambda x: 'Positive' if x > 0 else ('Negative' if
                                                                           x < 0 else 'Neutral'))
6
7 sentiment_counts_df1 = df1['Sentiment'].value_counts(normalize=True)
8 sentiment_counts_df2 = df2['Sentiment'].value_counts(normalize=True)
9 sentiment_counts_df3 = df3['Sentiment'].value_counts(normalize=True)
10
11 # Creating a data frame for plotting
12 sentiment_distribution = pd.DataFrame({
13     'Brand': ['AppleWatch'] * len(sentiment_counts_df1) + ['OuraRing'] * len(
14         sentiment_counts_df2) + ['
15         GarminWatches'] * len(
16         sentiment_counts_df3),
17     'Sentiment': sentiment_counts_df1.index.tolist() + sentiment_counts_df2.index.tolist()
18         + sentiment_counts_df3.index.tolist(),
19     'Frequency': sentiment_counts_df1.values.tolist() + sentiment_counts_df2.values.tolist()
20         + sentiment_counts_df3.values.
21         tolist()
22 })
23
24 # Draw a frequency distribution graph of sentiment classification
25 plt.figure(figsize=(10, 6))
26 sns.barplot(x='Brand', y='Frequency', hue='Sentiment', data=sentiment_distribution)
27 plt.title('Sentiment Distribution by Brand')
28 plt.ylabel('Frequency')
29 # save the figure as a pdf file
```



```

24 plt.savefig('sentiment_distribution.pdf', format='pdf')
25 plt.show()
26
27 contingency_table = pd.crosstab(
28     np.concatenate([np.repeat('AppleWatch', len(df1)), np.repeat('OuraRing', len(df2)), np
29         .repeat('GarminWatches', len(df3))]),
30     pd.concat([df1['Sentiment'], df2['Sentiment'], df3['Sentiment']])
31 )
32
33 chi2, p_val, dof, expected = chi2_contingency(contingency_table)
34 print(f'Chi-Square Test: Chi2={chi2}, p_val={p_val}')

```

Chi-Square Test: Chi2=1174.4018129088843, p_val=5.641729346523474e-253

```

1 df1['Comment Time'] = pd.to_datetime(df1['Comment Time'])
2 df2['Comment Time'] = pd.to_datetime(df2['Comment Time'])
3 df3['Comment Time'] = pd.to_datetime(df3['Comment Time'])
4
5 df1['Post Time'] = pd.to_datetime(df1['Post Time'])
6 df2['Post Time'] = pd.to_datetime(df2['Post Time'])
7 df3['Post Time'] = pd.to_datetime(df3['Post Time'])
8
9 df1['YearMonth'] = df1['Comment Time'].dt.to_period('M')
10 df2['YearMonth'] = df2['Comment Time'].dt.to_period('M')
11 df3['YearMonth'] = df3['Comment Time'].dt.to_period('M')
12
13 df1_monthly_polarity = df1.groupby('YearMonth')['Polarity'].mean()
14 df2_monthly_polarity = df2.groupby('YearMonth')['Polarity'].mean()
15 df3_monthly_polarity = df3.groupby('YearMonth')['Polarity'].mean()
16
17 df1_monthly_count = df1.groupby('YearMonth')['Polarity'].count()
18 df2_monthly_count = df2.groupby('YearMonth')['Polarity'].count()
19 df3_monthly_count = df3.groupby('YearMonth')['Polarity'].count()
20
21 plt.figure(figsize=(12, 6))
22 plt.plot(df1_monthly_polarity.index.to_timestamp(), df1_monthly_polarity, label='Apple
23     Watch')
24 plt.plot(df2_monthly_polarity.index.to_timestamp(), df2_monthly_polarity, label='Oura Ring
25     ')
26 plt.plot(df3_monthly_polarity.index.to_timestamp(), df3_monthly_polarity, label='Garmin
27     Watches')
28
29 plt.xlabel('Year-Month')
30 plt.ylabel('Monthly Average Polarity')
31 plt.title('Monthly Average Polarity for Each Company')
32 plt.legend()
33 plt.grid(True)
34 # save the figure as a pdf file
35 plt.savefig('monthly_average_polarity.pdf', format='pdf')
36 plt.show()
37
38 plt.figure(figsize=(12, 6))
39 plt.plot(df1_monthly_count.index.to_timestamp(), df1_monthly_count, label='Apple Watch')
40 plt.plot(df2_monthly_count.index.to_timestamp(), df2_monthly_count, label='Oura Ring')
41 plt.plot(df3_monthly_count.index.to_timestamp(), df3_monthly_count, label='Garmin Watches')
42
43 plt.xlabel('Year-Month')
44 plt.ylabel('Monthly Comment Count')
45 plt.title('Monthly Comment Count for Each Company')
46 plt.legend()
47 plt.grid(True)
48 # save the figure as a pdf file
49 plt.savefig('monthly_comment_count.pdf', format='pdf')
50 plt.show()
51
52 df1_weighted_polarity = df1_monthly_polarity * df1_monthly_count
53 df2_weighted_polarity = df2_monthly_polarity * df2_monthly_count
54 df3_weighted_polarity = df3_monthly_polarity * df3_monthly_count
55
56 plt.figure(figsize=(12, 6))
57 plt.plot(df1_weighted_polarity.index.to_timestamp(), df1_weighted_polarity, label='Apple
58     Watch')
59 plt.plot(df2_weighted_polarity.index.to_timestamp(), df2_weighted_polarity, label='Oura

```

```

54 plt.plot(df3_weighted_polarity.index.to_timestamp(), df3_weighted_polarity, label='Garmin
    Ring')
55 plt.xlabel('Year-Month')
56 plt.ylabel('Monthly Average Polarity * Comment Count')
57 plt.title('Monthly Weighted Polarity for Each Company')
58 plt.legend()
59 plt.grid(True)
60 # save the figure as a pdf file
61 plt.savefig('monthly_weighted_polarity.pdf', format='pdf')
62 plt.show()

```

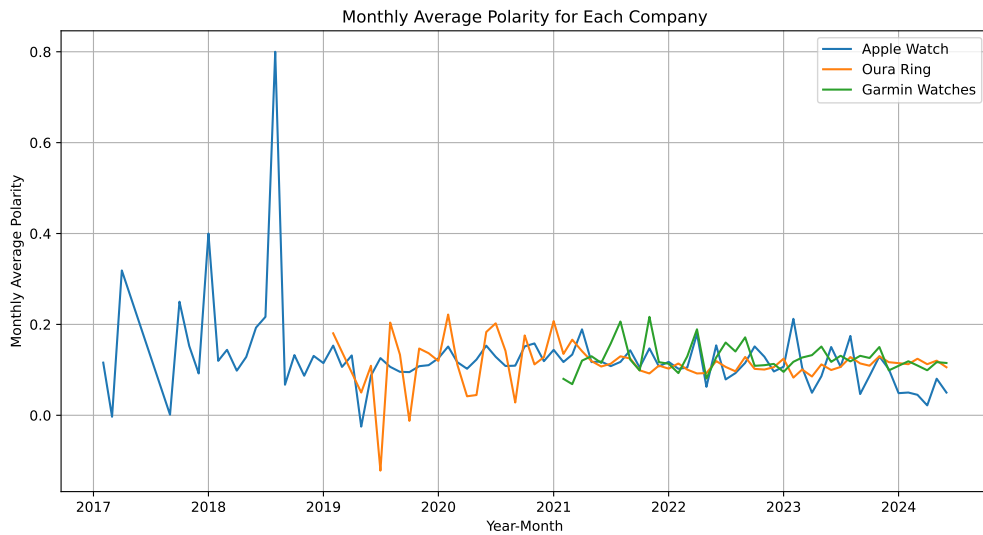


Figure 12: Monthly Average Polarity for Each Company

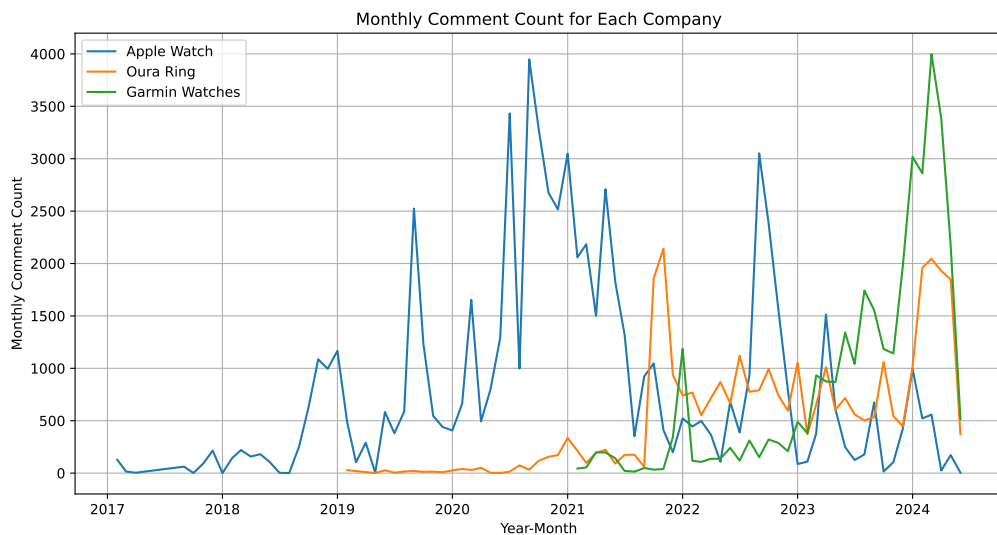


Figure 13: Monthly Comment Count for Each Company

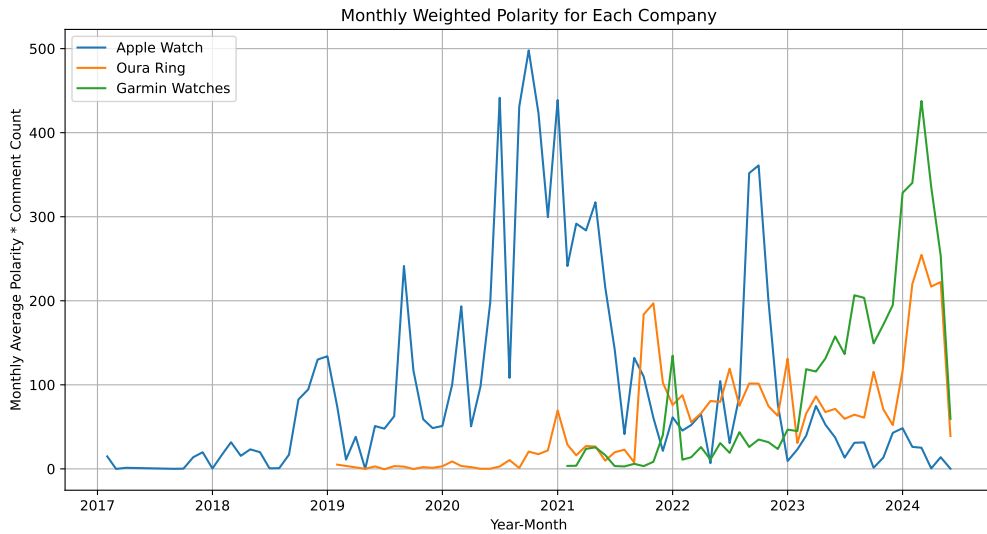


Figure 14: Monthly Weighted Polarity for Each Company

```

1 df1['YearMonth'] = df1['Post Time'].dt.to_period('M')
2 df2['YearMonth'] = df2['Post Time'].dt.to_period('M')
3 df3['YearMonth'] = df3['Post Time'].dt.to_period('M')
4
5 df1_monthly_polarity = df1.groupby('YearMonth')['Polarity'].mean()
6 df2_monthly_polarity = df2.groupby('YearMonth')['Polarity'].mean()
7 df3_monthly_polarity = df3.groupby('YearMonth')['Polarity'].mean()
8
9 df1_monthly_count = df1.groupby('YearMonth')['Polarity'].count()
10 df2_monthly_count = df2.groupby('YearMonth')['Polarity'].count()
11 df3_monthly_count = df3.groupby('YearMonth')['Polarity'].count()
12
13 plt.figure(figsize=(12, 6))
14 plt.plot(df1_monthly_polarity.index.to_timestamp(), df1_monthly_polarity, label='Apple
    Watch')
15 plt.plot(df2_monthly_polarity.index.to_timestamp(), df2_monthly_polarity, label='Oura Ring
    ')
16 plt.plot(df3_monthly_polarity.index.to_timestamp(), df3_monthly_polarity, label='Garmin
    Watches')
17 plt.xlabel('Year-Month')
18 plt.ylabel('Post Time Monthly Average Polarity')
19 plt.title('Monthly Average Polarity for Each Company')
20 plt.legend()
21 plt.grid(True)
22 # save the figure as a pdf file
23 plt.savefig('monthly_average_polarity_post_time.pdf', format='pdf')
24 plt.show()
25
26 plt.figure(figsize=(12, 6))
27 plt.plot(df1_monthly_count.index.to_timestamp(), df1_monthly_count, label='Apple Watch')
28 plt.plot(df2_monthly_count.index.to_timestamp(), df2_monthly_count, label='Oura Ring')
29 plt.plot(df3_monthly_count.index.to_timestamp(), df3_monthly_count, label='Garmin Watches'
    )
30 plt.xlabel('Year-Month')
31 plt.ylabel('Monthly Comment Count')
32 plt.title('Post Time Monthly Comment Count for Each Company')
33 plt.legend()
34 plt.grid(True)
35 # save the figure as a pdf file
36 plt.savefig('monthly_comment_count_post_time.pdf', format='pdf')
37 plt.show()
38
39 df1_weighted_polarity = df1_monthly_polarity * df1_monthly_count
40 df2_weighted_polarity = df2_monthly_polarity * df2_monthly_count
41 df3_weighted_polarity = df3_monthly_polarity * df3_monthly_count

```

```

42
43 plt.figure(figsize=(12, 6))
44 plt.plot(df1_weighted_polarity.index.to_timestamp(), df1_weighted_polarity, label='Apple
45 Watch')
46 plt.plot(df2_weighted_polarity.index.to_timestamp(), df2_weighted_polarity, label='Oura
47 Ring')
48 plt.plot(df3_weighted_polarity.index.to_timestamp(), df3_weighted_polarity, label='Garmin
49 Watches')
50 plt.xlabel('Year-Month')
51 plt.ylabel('Monthly Average Polarity * Comment Count')
52 plt.title('Post Time Monthly Weighted Polarity for Each Company')
53 plt.legend()
54 plt.grid(True)
55 # save the figure as a pdf file
56 plt.savefig('monthly_weighted_polarity_post_time.pdf', format='pdf')
57 plt.show()

```

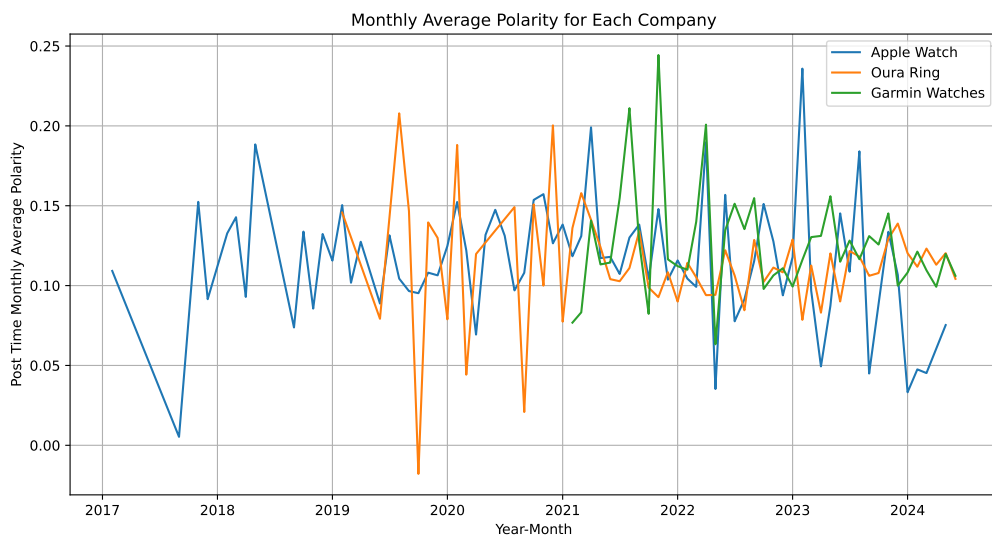


Figure 15: Post Time Monthly Average Polarity for Each Company

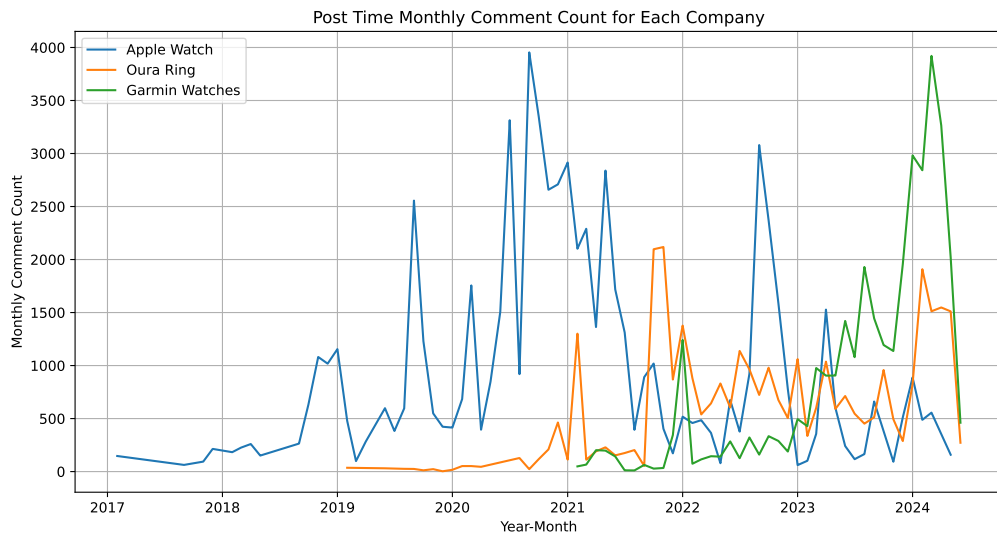


Figure 16: Post Time Monthly Comment Count for Each Company

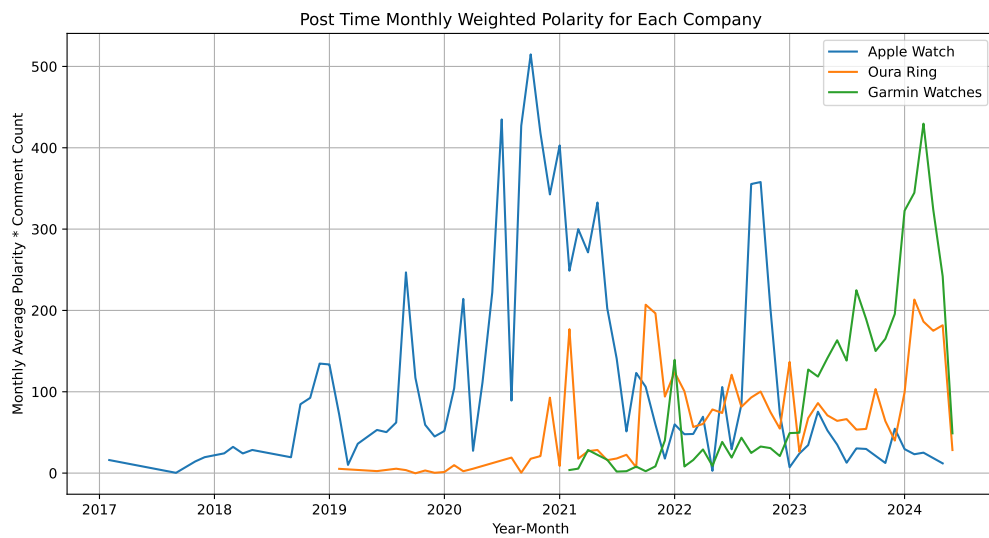


Figure 17: Post Time Monthly Weighted Polarity for Each Company

```

1 # calculate the difference between the post time and comment time with days
2 # apple
3 df1['Time_Difference'] = (df1['Post Time'] - df1['Comment Time']).dt.days
4 # ouraring
5 df2['Time_Difference'] = (df2['Post Time'] - df2['Comment Time']).dt.days
6 # garmin
7 df3['Time_Difference'] = (df3['Post Time'] - df3['Comment Time']).dt.days
8 print(df1['Time_Difference'].describe(), df2['Time_Difference'].describe(), df3['
    Time_Difference'].describe())
9
10 Z1 = (df1['Time_Difference'] - df1['Time_Difference'].mean()) / df1['Time_Difference'].std
    ()
11 Z2 = (df2['Time_Difference'] - df2['Time_Difference'].mean()) / df2['Time_Difference'].std
    ()
12 Z3 = (df3['Time_Difference'] - df3['Time_Difference'].mean()) / df3['Time_Difference'].std
    ()
13 # check the z-scores's skewness and kurtosis
14 print(f'Apple Watch': skew={Z1.skew()}, kurt={Z1.kurt()})
15 print(f'Oura Ring': skew={Z2.skew()}, kurt={Z2.kurt()})
16 print(f'Garmin Watches': skew={Z3.skew()}, kurt={Z3.kurt()})
17 # print(Z1.skew(), Z1.kurt(), Z2.skew(), Z2.kurt(), Z3.skew(), Z3.kurt())

```

```

count      70832.000000
mean        -5.568331
std         57.533213
min        -2238.000000
25%         -1.000000
50%         -1.000000
75%         -1.000000
max          0.000000
Name: Time_Difference, dtype: float64 count      33902.000000
mean        -63.340629
std         216.645668
min        -1738.000000
25%         -2.000000
50%         -1.000000
75%         -1.000000
max         -1.000000
Name: Time_Difference, dtype: float64 count      33937.000000

```

```

mean      -6.698441
std       36.971332
min       -1020.000000
25%       -1.000000
50%       -1.000000
75%       -1.000000
max       -1.000000
Name: Time_Difference, dtype: float64

```

```

Apple Watch: skew=-19.667515950629706, kurt=466.6991695008059
Oura Ring: skew=-3.974401211107, kurt=15.444727357463641
Garmin Watches: skew=-10.049429147379271, kurt=129.3241460304709

```

```

1 from scipy import stats
2 from scipy.stats import f_oneway, chi2_contingency
3
4 # Function to parse dates and filter dataframes based on the earliest comment time
5 def filter_dataframes_by_earliest_comment_time(df1, df2, df3):
6     df1['Comment Time'] = pd.to_datetime(df1['Comment Time'])
7     df2['Comment Time'] = pd.to_datetime(df2['Comment Time'])
8     df3['Comment Time'] = pd.to_datetime(df3['Comment Time'])
9
10    earliest_time_oura = df2['Comment Time'].min()
11    earliest_time_garmin = df3['Comment Time'].min()
12
13    df1_filtered_oura = df1[df1['Comment Time'] >= earliest_time_oura]
14    df2_filtered_oura = df2[df2['Comment Time'] >= earliest_time_oura]
15
16    df1_filtered_garmin = df1[df1['Comment Time'] >= earliest_time_garmin]
17    df3_filtered_garmin = df3[df3['Comment Time'] >= earliest_time_garmin]
18
19    df2_filtered_garmin = df2[df2['Comment Time'] >= earliest_time_garmin]
20    df3_filtered_oura = df3[df3['Comment Time'] >= earliest_time_garmin]
21
22    df1_filtered_all = df1[df1['Comment Time'] >= earliest_time_garmin]
23    df2_filtered_all = df2[df2['Comment Time'] >= earliest_time_garmin]
24    df3_filtered_all = df3[df3['Comment Time'] >= earliest_time_garmin]
25
26    return (df1_filtered_oura, df2_filtered_oura, df1_filtered_garmin, df3_filtered_garmin,
27            df2_filtered_garmin,
28            df3_filtered_oura, df1_filtered_all,
29            df2_filtered_all, df3_filtered_all)
30
31 # Function to perform t-tests between two dataframes
32 def perform_t_test(df1, df2):
33     t_stat, p_val = stats.ttest_ind(df1['Polarity'], df2['Polarity'])
34     return t_stat, p_val
35
36 # Function to perform ANOVA test on three dataframes
37 def perform_anova(df1, df2, df3):
38     f_stat, p_val = f_oneway(df1['Polarity'], df2['Polarity'], df3['Polarity'])
39     return f_stat, p_val
40
41 # Function to perform Chi-Square test on three dataframes
42 def perform_chi_square(df1, df2, df3):
43     contingency_table = pd.crosstab(
44         np.concatenate([np.repeat('AppleWatch', len(df1)), np.repeat('OuraRing', len(df2)),
45                             np.repeat('GarminWatches', len(df3))]),
46         pd.concat([df1['Sentiment'], df2['Sentiment'], df3['Sentiment']])
47     )
48
49     chi2, p_val, dof, expected = chi2_contingency(contingency_table)
50     return chi2, p_val
51
52 # Filter the dataframes based on the earliest comment time
53 df1_filtered_oura, df2_filtered_oura, df1_filtered_garmin, df3_filtered_garmin,
54     df2_filtered_garmin, df3_filtered_oura, df1_filtered_all, df2_filtered_all,
55     df3_filtered_all =

```

```

filter_dataframes_by_earliest_comment_time
(df1, df2, df3)

3
4 # Perform t-tests
5 t_stat_apple_oura, p_val_apple_oura = perform_t_test(df1_filtered_oura, df2_filtered_oura)
6 print(f'Apple Watch vs Oura Ring: t_stat={t_stat_apple_oura}, p_val={p_val_apple_oura}')
7
8 t_stat_apple_garmin, p_val_apple_garmin = perform_t_test(df1_filtered_garmin,
9                                                         df3_filtered_garmin)
10 print(f'Apple Watch vs Garmin Watches: t_stat={t_stat_apple_garmin}, p_val={
11                                                         p_val_apple_garmin}')
12
13 t_stat_oura_garmin, p_val_oura_garmin = perform_t_test(df2_filtered_garmin,
14                                                         df3_filtered_oura)
15 print(f'Oura Ring vs Garmin Watches: t_stat={t_stat_oura_garmin}, p_val={p_val_oura_garmin
16                                                         }')
17
18 # Perform ANOVA test
19 f_stat, p_val = perform_anova(df1_filtered_all, df2_filtered_all, df3_filtered_all)
20 print(f'ANOVA: F_stat={f_stat}, p_val={p_val}')
21
22 # Perform Chi-Square test
23 chi2, p_val = perform_chi_square(df1_filtered_all, df2_filtered_all, df3_filtered_all)
24 print(f'Chi-Square Test: Chi2={chi2}, p_val={p_val}')

```

```

Apple Watch vs Oura Ring: t_stat=5.3004860011289585, p_val=1.1574071745687665e-07
Apple Watch vs Garmin Watches: t_stat=-0.8837417860409237, p_val=0.3768388652504344
Oura Ring vs Garmin Watches: t_stat=-4.129723601852109, p_val=3.6364214752093014e-05
ANOVA: F_stat=8.428322894708987, p_val=0.00021874617130214944
Chi-Square Test: Chi2=787.0403839188344, p_val=4.925171415650732e-169

```

```

1 # Function to filter dataframes for the last two years from June 2022 to present
2 def filter_last_two_years(df1, df2, df3):
3     start_date = pd.to_datetime('2022-09-08')
4     df1_filtered = df1[df1['Comment Time'] >= start_date]
5     df2_filtered = df2[df2['Comment Time'] >= start_date]
6     df3_filtered = df3[df3['Comment Time'] >= start_date]
7     return df1_filtered, df2_filtered, df3_filtered
8
9 # Assuming df1, df2, df3 are already loaded and represent Apple Watch, Oura Ring, and
10 # Garmin Watches datasets respectively
11
12 # Filter the dataframes for the last two years
13 df1_last_two_years, df2_last_two_years, df3_last_two_years = filter_last_two_years(df1,
14 df2, df3)
15
16 # Perform t-tests on the last two years' data
17 t_stat_apple_oura, p_val_apple_oura = perform_t_test(df1_last_two_years,
18 df2_last_two_years)
19 print(f'Apple Watch vs Oura Ring (last two years): t_stat={t_stat_apple_oura}, p_val={
20 p_val_apple_oura}')
21
22 t_stat_apple_garmin, p_val_apple_garmin = perform_t_test(df1_last_two_years,
23 df3_last_two_years)
24 print(f'Apple Watch vs Garmin Watches (last two years): t_stat={t_stat_apple_garmin},
25 p_val={p_val_apple_garmin}')
26
27 t_stat_oura_garmin, p_val_oura_garmin = perform_t_test(df2_last_two_years,
28 df3_last_two_years)
29 print(f'Oura Ring vs Garmin Watches (last two years): t_stat={t_stat_oura_garmin}, p_val={
30 p_val_oura_garmin}')
31
32 # Perform ANOVA test on the last two years' data
33 f_stat, p_val = perform_anova(df1_last_two_years, df2_last_two_years, df3_last_two_years)
34 print(f'ANOVA (last two years): F_stat={f_stat}, p_val={p_val}')
35
36 # Perform Chi-Square test on the last two years' data
37 chi2, p_val = perform_chi_square(df1_last_two_years, df2_last_two_years,
38 df3_last_two_years)
39 print(f'Chi-Square Test (last two years): Chi2={chi2}, p_val={p_val}')

```


Apple Watch vs Oura Ring (last two years): t_stat=-4.233802103005804, p_val=2.3036569743351748e-05
Apple Watch vs Garmin Watches (last two years): t_stat=-6.16667976321056, p_val=7.033257332307025e-05
Oura Ring vs Garmin Watches (last two years): t_stat=-1.7841702000320818, p_val=0.07440200515880102
ANOVA (last two years): F_stat=19.574273681959756, p_val=3.1736552051196612e-09
Chi-Square Test (last two years): Chi2=403.91674780730546, p_val=3.9627768219353446e-86