Enhancing Diabetes Care:

Unveiling Continuous Glucose Monitoring Perspectives and Product Insights through Social Media Analytics

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Data Science for Product Managers

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Analytics Pathway

- Exploratory Data Analysis
- Topic Modelling
- Sentiment Analysis
- Machine Learning Model
- Product Specific Analysis
- Large Language Models

Introduction to CGMs: A quick Dive into the Domain of our analysis

- Continuous Glucose Monitoring (CGM) is a technology used for monitoring glucose levels in real-time.

- CGMs consist of a small sensor that is inserted under the skin, a transmitter that sends data to a receiver or smartphone, and a software platform for data analysis.

- Using CGMs, individuals with diabetes can track their glucose levels throughout the day and identify trends and patterns that help them make informed decisions about their medication, diet, and lifestyle.

- CGMs provide valuable insights into how different foods, activities, and medications affect blood sugar levels, allowing users to make necessary adjustments to manage their condition effectively.

Executive Summary

- CGM devices offer continuous monitoring of glucose levels, providing real-time data to help diabetes patients manage their condition more effectively.

- Patients seek improved accuracy, ease of use, better integration with wearable technology, reduced sensor errors, longer sensor lifespans, and better affordability.

- Users appreciate Dexcom's accuracy, integration with smart devices, real-time monitoring, reliability and automated insulin dosing.

- Common complaints from Dexcom include sensor inaccuracies, adhesion issues, occasional false alarms, the need for frequent calibrations, limited smartwatch compatibility, and high costs.

- Users recommend Freestyle Libre's ease of use, longer sensor life, reduced invasiveness (no fingersticks), affordability compared to other CGMs

- Common complaints involve occasional sensor errors, issues with sensor adhesion, lack of real-time alerts, less accuracy during rapid glucose changes, and the need for a separate reader.

Exploratory Data Analysis

- Data Pre-processing Technique: Employing a bag of words model (Count Vectorizer)

- N-gram analysis: Bigram and Trigram model utilized to understand context

- POS Tagging: Insights gathered from Part-of-Speech (POS) tagging, identifying the types of words (nouns, verbs, adjectives, etc.) and their frequencies within the text data.

- User Engagement Metrics through different social media platforms

Exploratory Data Analysis

Most Common Roots in Cleaned Text

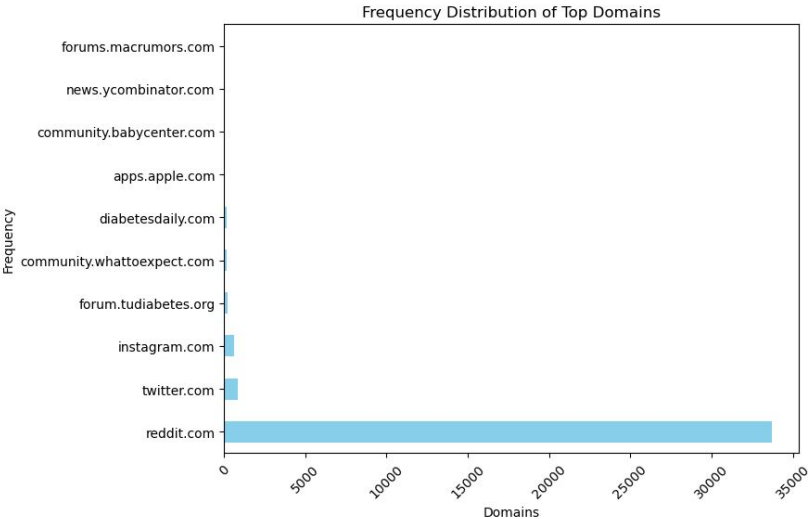
Overall Distribution of Sentiments
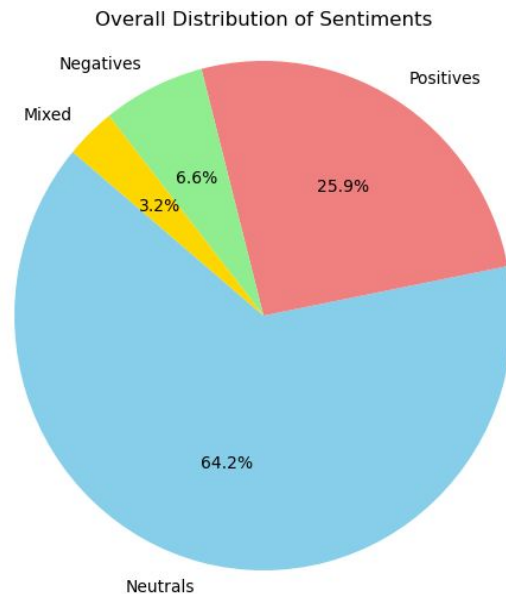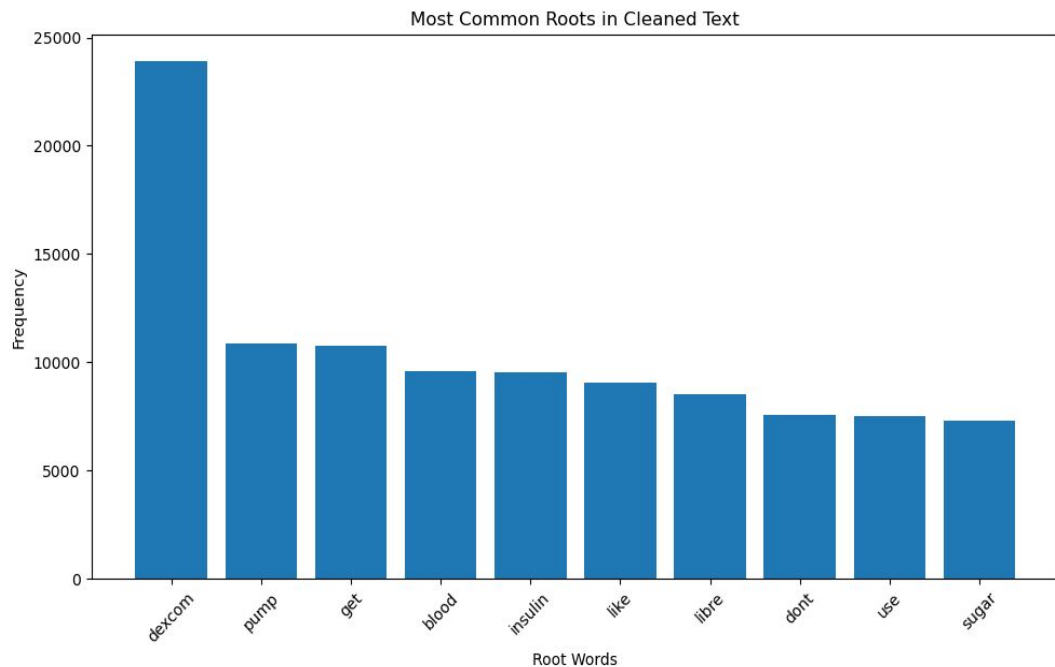
The dataset contains text about device experiences, cgm systems, personal health experiences, healthcare challenges, medical advice and recommendations.
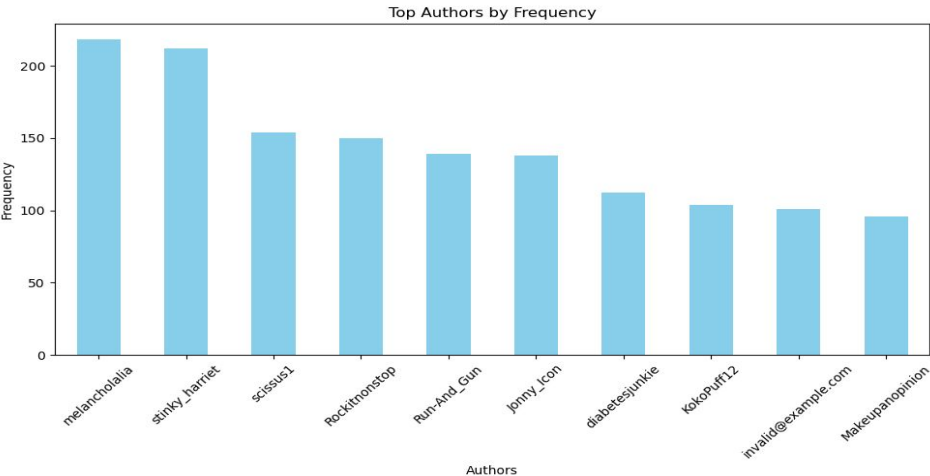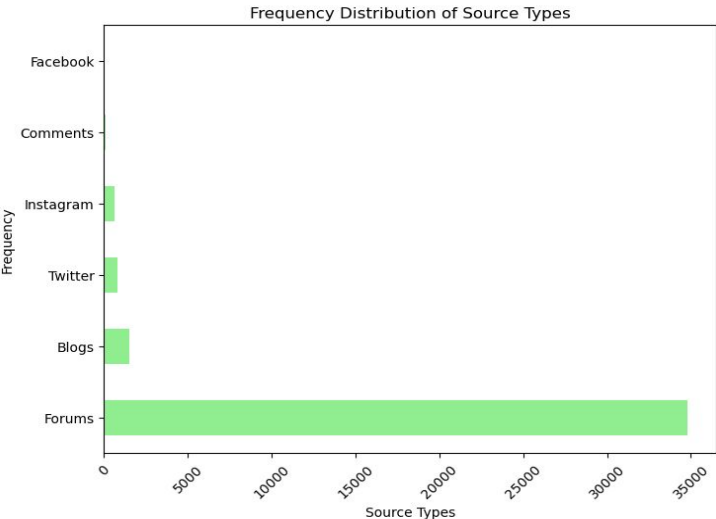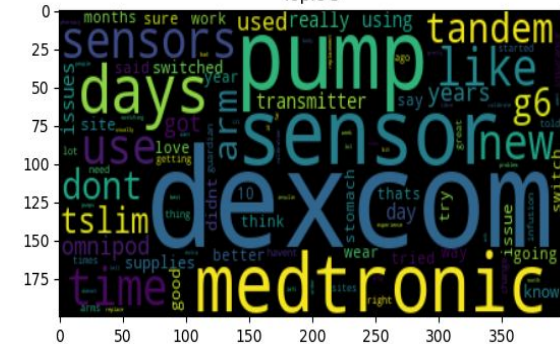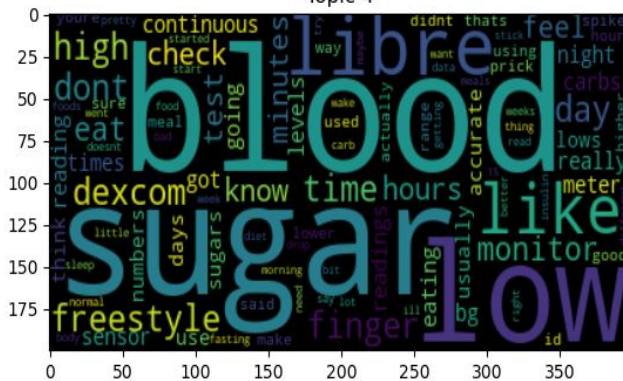
User Engagement Analysis

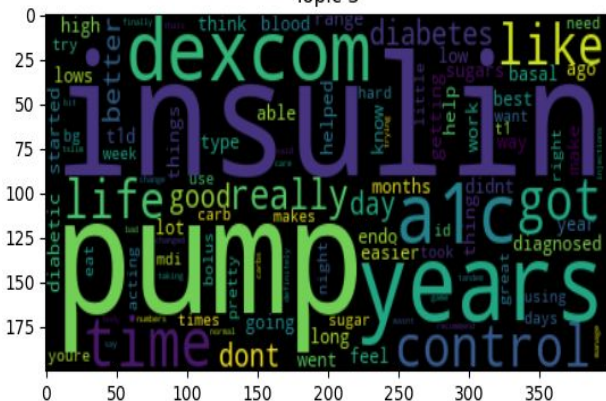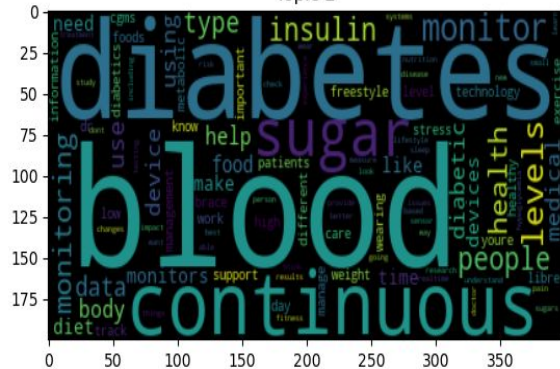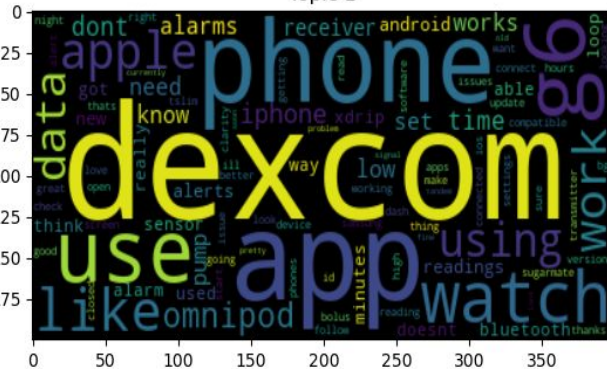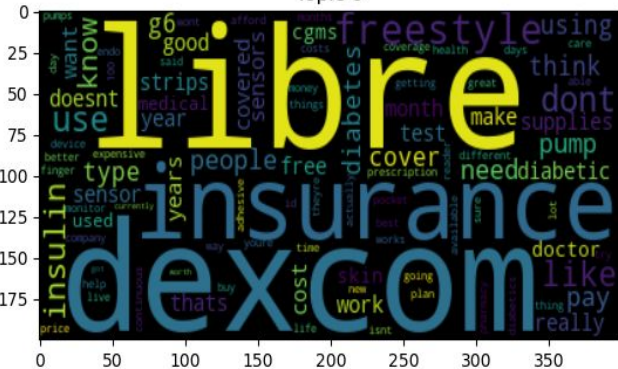
Monthly Volume of Posts Over Time
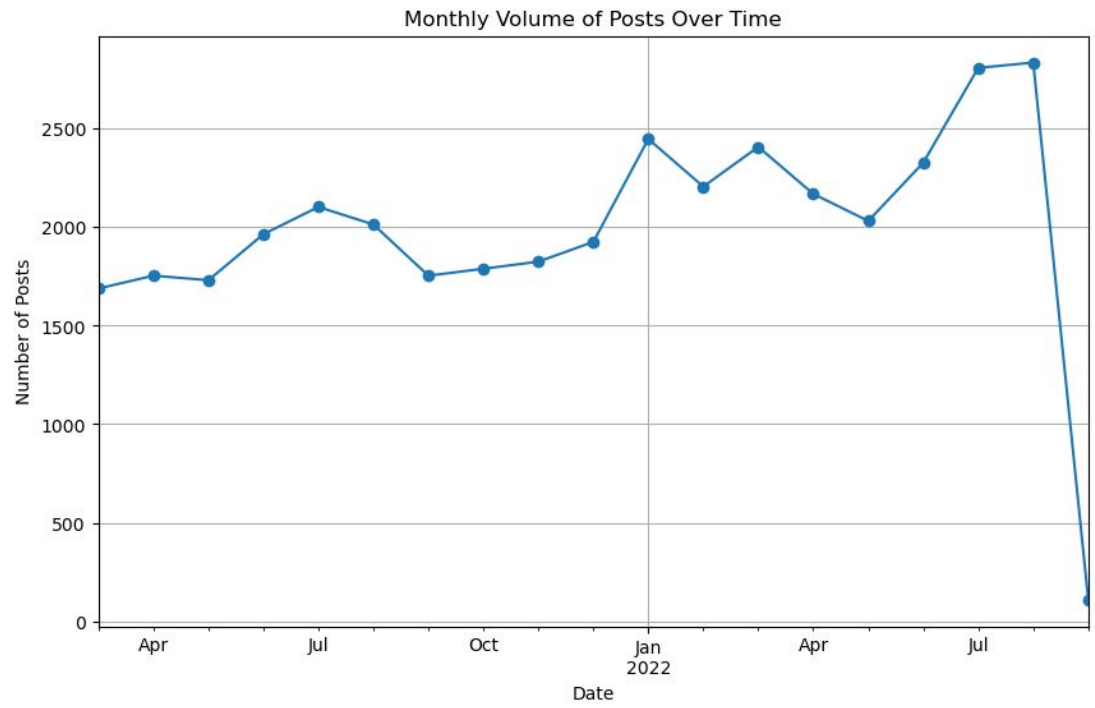
User Engagement Analysis

Reddit leads the way with the most active engagement metrics!

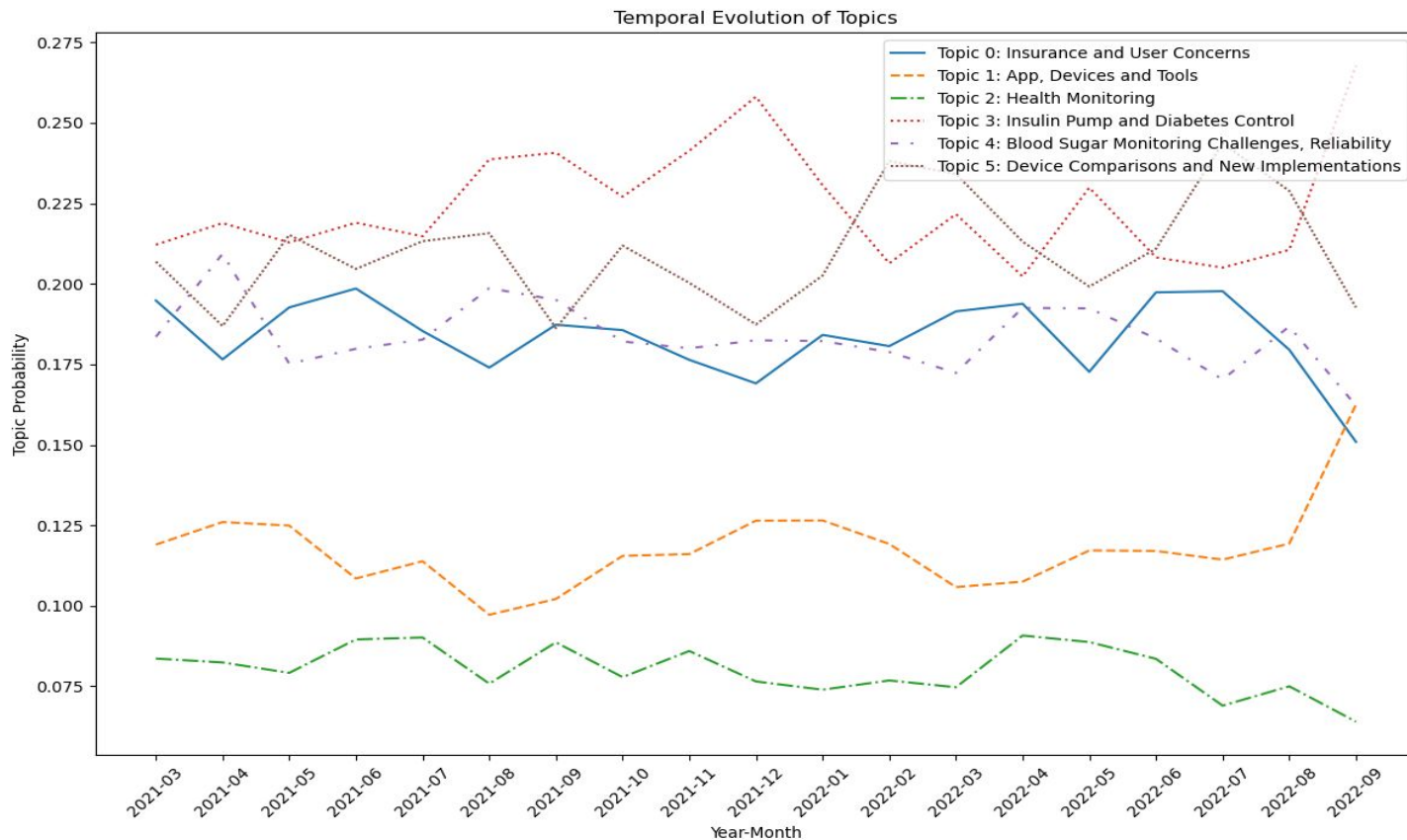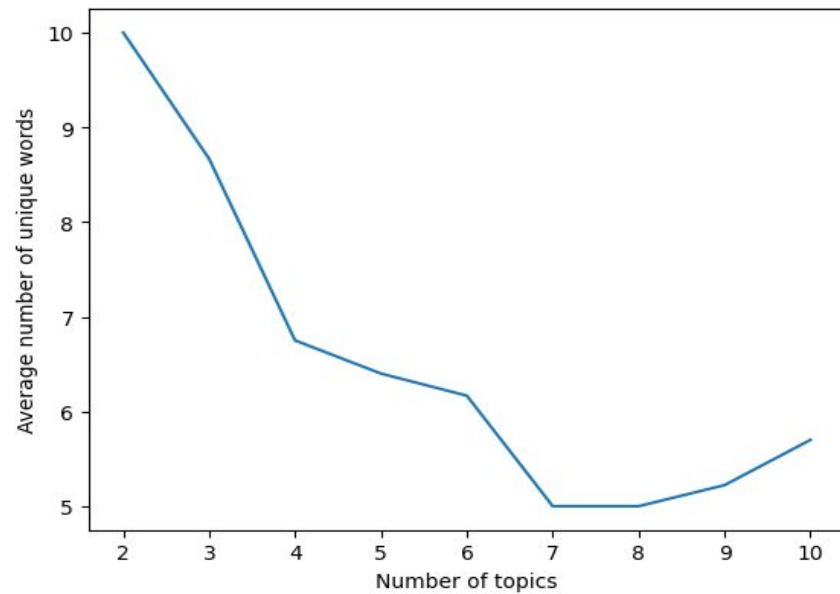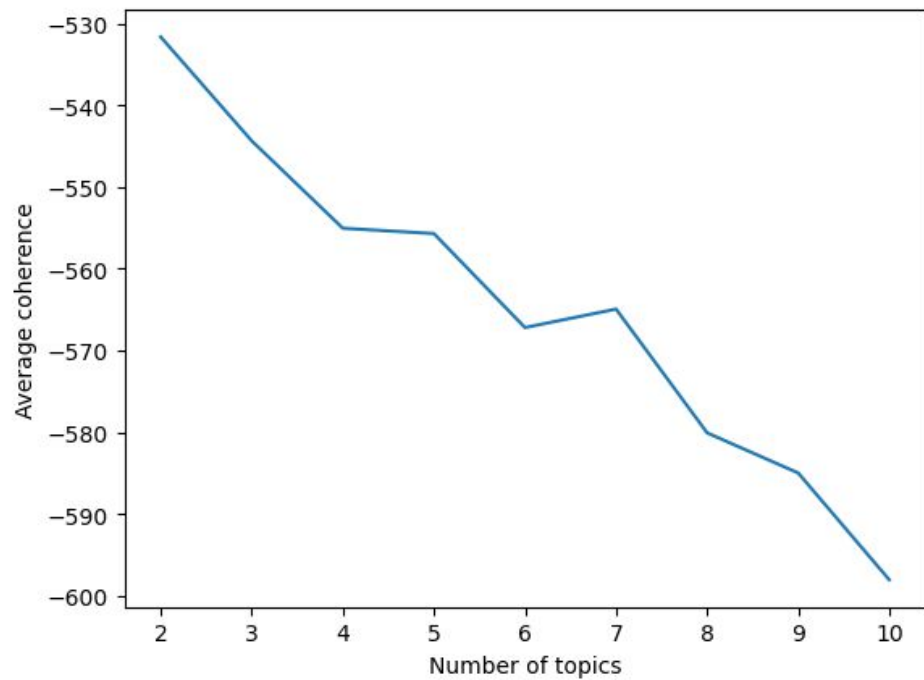# Topic Modelling: Latent Dirichlet Allocation

LDA- Major Topics

- Topic 0 - Insurance and User Concerns: Insurance coverage issues, user experiences, and concerns about device use.

- Topic 1 - App, Devices and Tools: Discussion around Dexcom app, phone compatibility, and device usability.

- Topic 2 - Health Monitoring and Diabetes Management: Focus on health monitoring, diabetes management, and continuous glucose monitoring, insuline levels.

- Topic 3 - Insulin Pump and Diabetes Control: Sentiments about insulin pumps, diabetes control, and managing A1C levels.
- Topic 4 - Blood Sugar Monitoring Challenges, Reliability: Discussions on blood sugar monitoring, device reliability, and monitoring difficulties.

- Topic 5 - Device Comparisons and New Implementations: Discussions involving comparisons with other devices, sensor usage, and mentions of different brands or implementations in diabetes management.
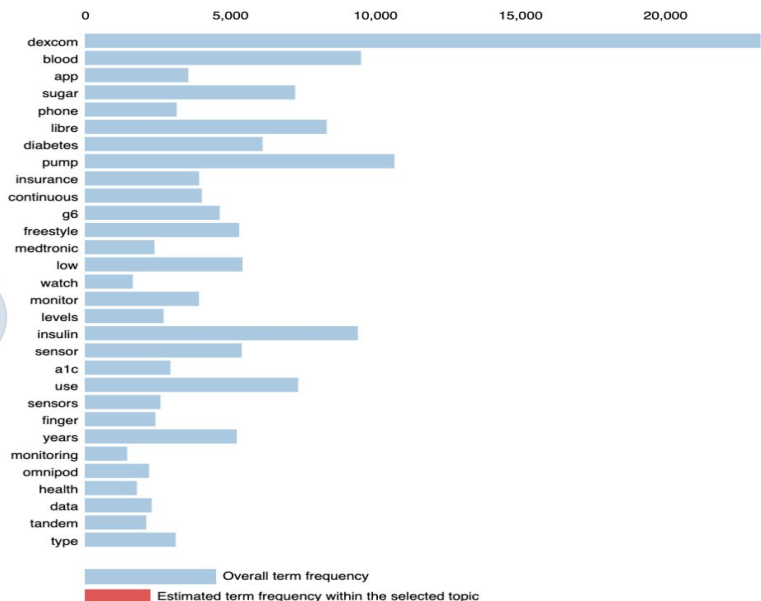
Temporal Topic Evolution

Temporal Evolution of Topics

LDA

LDA Demo?

Machine Learning and Sentiment Analysis Results

Random Forest: ~70%

Decision Trees: ~63%

SVM: ~58%

Lots of overlapping classes makes it difficult for SVM, Random Forest performs comparatively better than others

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Sentiment Rating 1: low, bad, dexcom, pain, hate, shit, hell, ill, wrong, get, problem, worst, alarm, alarms, lows, failed, dont, like, tired, time, pump, one, would, insulin, severe
Sentiment Rating 2: dexcom, low, pump, get, like, dont, libre, pay, ill, time, use, insulin, weird, one, also, lower, got, blood, sensor, would, using, freestyle, hard, lows, sugar
Sentiment Rating 3: dexcom, like, use, pump, g6, good, get, libre, dont, low, one, better, insulin, continuous, freestyle, got, would, well, love, using, know, never, also, time, think
Sentiment Rating 4: dexcom, freestyle, libre, like, pump, use, get, insulin, dont, time, one, would, best, well, sensor, also, know, g6, blood, years, much, using, used, got, app
Sentiment Rating 5: best, love, like, great, good, better, pretty, free, help, dexcom, happy, well, low, sure, amazing, thanks, super, easier, kind, libre, hope, get, dont, pump, definitely
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Dexcom

Praises

- Users appreciate Dexcom, particularly the Dexcom G6
- Appreciation for real-time alerts for high or low glucose levels,
- Data sharing functionalities, and potential integration with smart devices gives Dexcom an edge
- Accuracy and alerts add to Dexcom's positive sentiments

Complaints

- Users faced some difficulties with sensors (usability)
- Issues with cost

Sentiment Distribution for Dexcom

Negatives
Mixed
8.0%
5.5%
Positives
29.4%
57.1%
Neutrals

Distribution of Sentiment Scores

Carnegie Mellon University
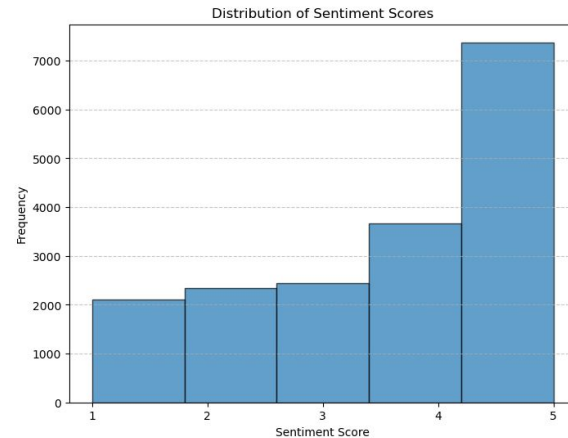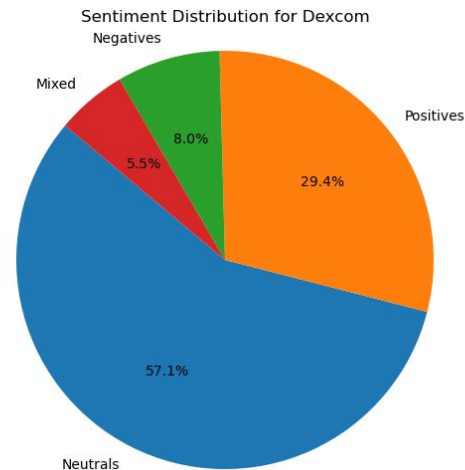
Dexcom

Positives:

Better integration and tools, finger sticks, recommended over medtronic by numerous users, Better control and management, alerts

" I'm going to switch to Tandem as soon as I get my pump upgrade (UK) A lot of wack shit with my 640G (no alarm when I run out of insulin?? Just when i'm on my last 10U, having pump recalled) and medtronic only taking action until people died is enough for me to say no more. I've only heard bad things about the Guardian sensor as well. Dexcom was rec'd by my doc as it is the best on the market if you can afford it."

"There's always the option of getting a MiaoMiao for a Libre, I've heard ... ... I've been using Dexcom for about four years now, and it's the one thing I couldn't live without, anymore. I remember, back when I was self-funding, thinking that I could lease a low end BMW for what I was paying"

"When I was using Dexcom, I used the Dexcom G6 app to manage the sensor, transmitter, etc. I connected Sugarmate (iOS app) to my Dexcom account as it provided insights in a way that I liked better."

"Switched to Dexcom's G6 and I'm never going back. So far just 2 finger sticks over the last 9 months. My fingers thank me tremendously for that."

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Top 20 most common bigrams:
[(('insulin', 'pump'), 238), (('closed', 'loop'), 162), (('control', 'iq'), 151), (('years', 'ago'), 136), (('tandem', 'tslim'), 129), (('
ch', 'better'), 122), (('apple', 'watch'), 119), (('dont', 'know'), 117), (('make', 'sure'), 101), (('type', 'diabetes'), 99), (('feel', '
ke'), 98), (('times', 'day'), 96), (('tslim', 'pump'), 95), (('highly', 'recommend'), 87), (('tandem', 'pump'), 85), (('loop', 'system'),
5), (('finger', 'sticks'), 79), (('every', 'minutes'), 76), (('good', 'luck'), 75), (('medtronic', 'pump'), 75)]

Top 20 most common trigrams:
[(('closed', 'loop', 'system'), 76), (('tandem', 'tslim', 'pump'), 35), (('use', 'tandem', 'tslim'), 32), (('tslim', 'control', 'iq'), 21)
(('insurance', 'wont', 'cover'), 20), (('tslim', 'insulin', 'pump'), 20), (('never', 'go', 'back'), 18), (('multiple', 'daily', 'injection
s'), 17), (('life', 'much', 'easier'), 16), (('long', 'acting', 'insulin'), 15), (('diagnosed', 'years', 'ago'), 14), (('put', 'new', 'sen
r'), 13), (('would', 'highly', 'recommend'), 13), (('use', 'omnipod', 'dash'), 13), (('highly', 'recommend', 'getting'), 13), (('durable',
'medical', 'equipment'), 13), (('best', 'thing', 'ever'), 12), (('two', 'years', 'ago'), 12), (('hybrid', 'closed', 'loop'), 12), (('use',
'insulin', 'pump'), 11)]
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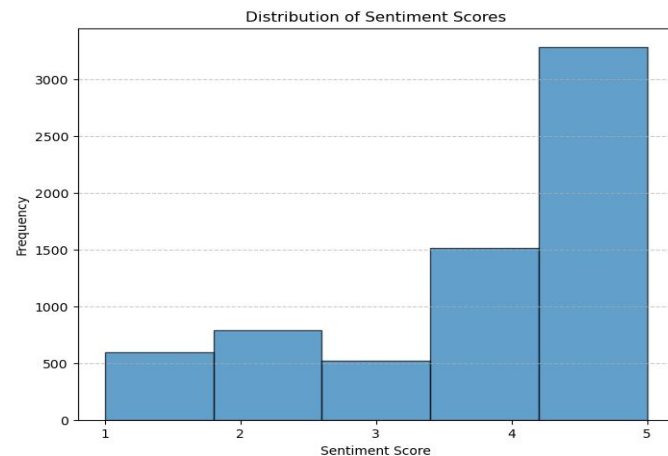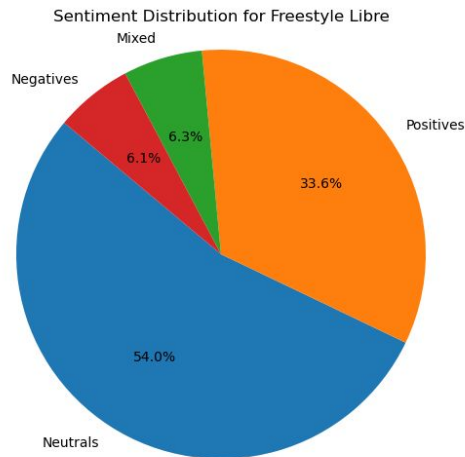
Freestyle Libre Analysis

Praises

- Easy to use
- Reduced finger pricks
- Comprehensive
- Affordability

Complaints

- Accuracy issues reported by some users
- Compatibility Issues

Sentiment Distribution for Freestyle Libre

Distribution of Sentiment Scores

Freestyle Libre Analysis

"Going through one of these services is considerably more expensive than getting it OTC outside of the USA. But these services also provide software (apps) that make the data useful. ==The native Freestyle Libre app is garbage.== Won't do much for you."

Positives: Affordability, no finger pricks, easy to use

Negatives: Accuracy and app integrations are not as good as Dexcom

"I have ADHD and I was really worried the sensors would be a constant physical annoyance. I gave the freestyle libre a go however and found that they're pretty unobtrusive, and massively helpful. ==Not having to do finger pricks== and just being able to scan and get results immediately and painlessly was a total game changer. "

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Top 20 most common bigrams:
[(('type', 'diabetes'), 225), (('insulin', 'pump'), 190), (('dont', 'know'), 188), (('test', 'strips'), 138), (('times', 'day'), 135), (('fi
nger', 'prick'), 133), (('back', 'brace'), 128), (('finger', 'sticks'), 125), (('finger', 'pricks'), 120), (('started', 'using'), 111), (('y
ears', 'ago'), 106), (('make', 'sure'), 104), (('apple', 'watch'), 103), (('much', 'better'), 101), (('every', 'minutes'), 96), (('medical',
'supply'), 95), (('high', 'low'), 95), (('finger', 'stick'), 92), (('even', 'though'), 90), (('feel', 'like'), 89)]

Top 20 most common trigrams:
[(('free', 'back', 'brace'), 86), (('medical', 'supply', 'brooklyn'), 63), (('people', 'type', 'diabetes'), 35), (('medical', 'supply', 'bro
nx'), 29), (('insurance', 'wont', 'cover'), 29), (('closed', 'loop', 'system'), 29), (('insurance', 'doesnt', 'cover'), 27), (('one', 'bac
k', 'injury'), 22), (('every', 'two', 'weeks'), 19), (('times', 'per', 'day'), 19), (('making', 'use', 'back'), 17), (('knee', 'dental', 'br
aces'), 17), (('back', 'injury', 'persistent'), 16), (('back', 'upper', 'arm'), 16), (('diagnosed', 'type', 'diabetes'), 16), (('belt', 'com
es', 'mind'), 15), (('free', 'knee', 'brace'), 15), (('every', 'five', 'minutes'), 15), (('abbott', 'diabetes', 'care'), 15), (('injury', 'p
ersistent', 'pain'), 13)]
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Carnegie Mellon University

POS-Tagging
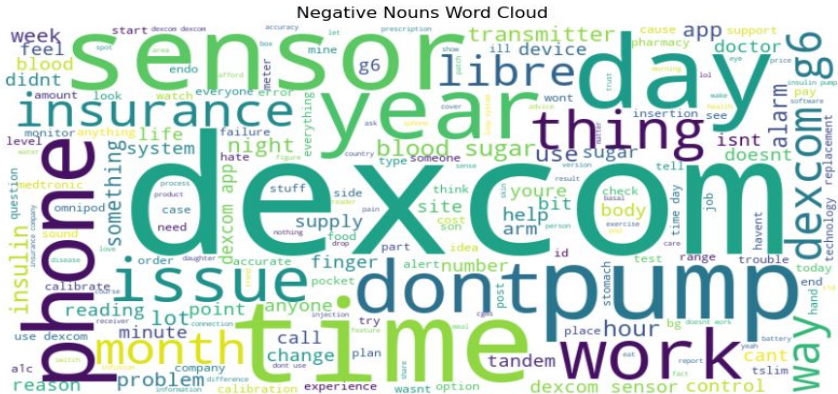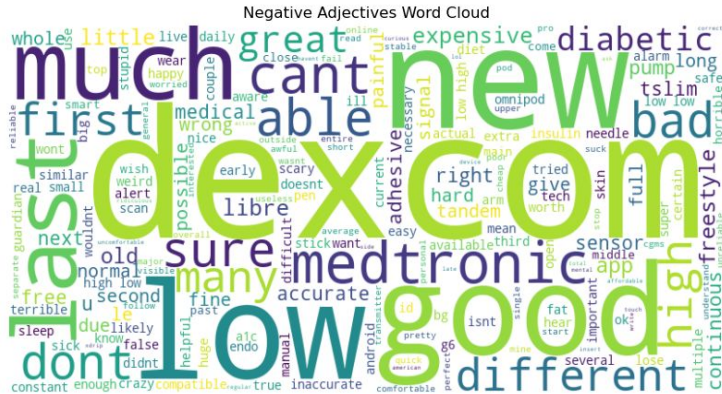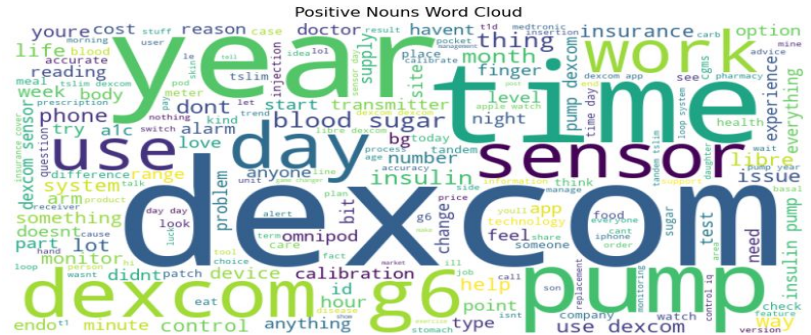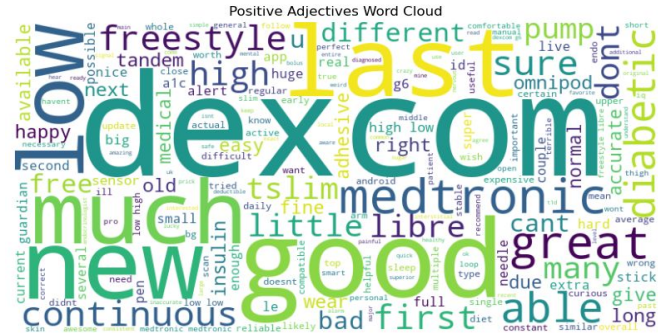
Recommendations and LLMs (OpenAI API)

Dexcom

- Dexcom can be expensive and may not be affordable for everyone especially without insurance coverage.

- Battery Considerations: Exploring rechargeable or replaceable battery options for transmitters could reduce waste and improve sustainability.'

- Increase lifespan of sensors: Users talked about continuous replacing sensors

- Since app connectivity is important and sets Dexcom apart, complaints regarding disconnections need to be addressed. (Bluetooth devices disconnecting)

Recommendations and LLMs (OpenAI API)

Freestyle Libre

- Connectivity & Sensor Reliability: Address sensor connectivity issues reported by some users to improve overall reliability. Ensuring the sensors are reachable and offer continuous and uninterrupted monitoring is crucial.

- App and Watch Connectivity: Enhance the Libre app's connectivity with smartwatches and phones for more reliable and real-time data updates, especially on the watch app.

- Accuracy & Alarms: Enhance the accuracy of readings and the reliability of alarms. Users have reported issues with sensor readings and alarms, requiring frequent checks and sometimes causing false low readings.

- Freestyle Libre requires regular sensor replacement, adding to the overall cost

THANK YOU