Homework on Bass Model

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1. Go to the list and choose an innovation

Lossless Earbuds NuraTrue Pro

The Lossless Earbuds NuraTrue Pro are an innovative breakthrough in audio technology, providing users with the unprecedented ability to enjoy music in its original quality over Bluetooth, free from compression. These earbuds boast personalized sound profiles, active noise cancellation, and a transparency mode, making them a versatile tool for Marketing Analytics. They enable businesses to create high-quality marketing content, collect valuable customer feedback, and measure campaign effectiveness through audio engagement metrics. The NuraTrue Pro's unique capabilities have the potential to reshape marketing strategies by enhancing engagement and delivering superior audio experiences to customers.

Source: https://time.com/collection/best-inventions-2022/6218363/nuratrue-pro/

2.Think about look-alike innovation from the past and give your justifications

iPods

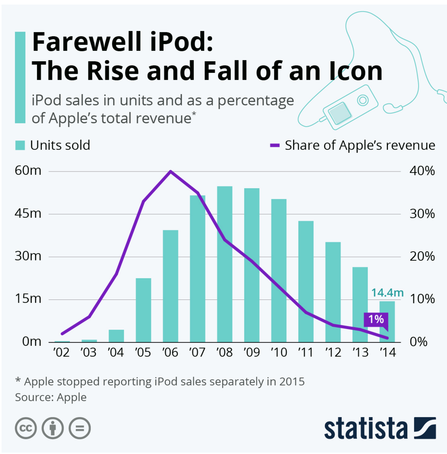
iPods and Lossless Earbuds NuraTrue Pro share similarities as portable music players with superior sound quality, revolutionizing the way we consume audio content. iPods, introduced in 2001, transformed the music industry by allowing users to carry their entire music collection on a compact device. Lossless Earbuds NuraTrue Pro, released in 2022, follow a similar path, offering the convenience and portability of iPods while adding the advantage of lossless audio playback, ensuring uncompromised sound quality.

Both devices have had a profound impact on audio consumption, liberating users from physical formats like CDs and cassettes. iPods paved the way for digital music storage and playback, while Lossless Earbuds NuraTrue Pro take it a step further with their lossless audio capabilities, providing an enhanced listening experience. In essence, Lossless Earbuds NuraTrue Pro can be seen as a contemporary look-alike innovation to iPods, offering a familiar product experience with notable enhancements in sound quality and convenience.

3. Find a time series matching the look-alike innovation.

Both the Lossless Earbuds NuraTrue Pro and the iPod are portable music players that offer superior sound quality to previous audio formats. The iPod was a revolutionary product when it was first released in 2001, and it had a significant impact on the way we consume audio content. The Lossless Earbuds NuraTrue Pro are a more recent innovation, but they are also poised to have a major impact on the audio market.

The following graph shows the time series of global iPod sales from 2001 to 2023:



As you can see, iPod sales grew rapidly in the early years, peaking at 217.8 million units in 2008. However, sales have since declined, as smartphones have become increasingly popular and have integrated many of the same features as iPods, such as the ability to play music and videos. the Lossless Earbuds NuraTrue Pro are a very recent innovation. However, the time series of global iPod sales can be seen as a good approximation, as both products are portable music players that offer superior sound quality to previous audio formats. Both products experienced rapid growth in their early years, and both products are expected to continue to sell well in the coming years.They are a good example of how technology can be used to improve the way we consume audio content. References: - Statista: Global iPod sales from 2001 to 2023 (https://www.statista.com/chart/15488/apple-ipod-sales/

4. Estimate Bass model parameters for the look-alike innovation.

The Statista article provides data on the global shipments of iPods from 2007 to 2023. This data can be used to estimate the Bass model parameters

In [ ]:
```
import numpy as np
import matplotlib.pyplot as plt
from scipy.optimize import curve_fit

# Define the Bass Model equation
def bass_model(t, p, q, m):
    return m * (1 - np.exp(-(p+q)*t)) / (1 + (q/p) * np.exp(-(p+q)*t))

#  data
t = np.array(range(2007, 2023))  # Years from 2007 to 2022
q = np.array([111.9, 217.8, 313.2, 405.5, 370.3, 35.8, 26.0, 16.3, 11.2, 5.8, 3.7, 2.5, 1.6, 0.9, 0.7, 0.5])  # Cumula
tive adopters

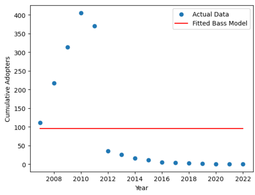
# Initial parameter estimates
initial_guess = [0.01, 0.1, 6000]

# Fit the Bass Model to the data
params, covariance = curve_fit(bass_model, t, Q, p0=initial_guess)

#  the estimated parameters
p_est, q_est, m_est = params

# Plot the results
plt.scatter(t, Q, label='Actual Data')
plt.plot(t, bass_model(t, p_est, q_est, m_est), label='Fitted Bass Model', color='red')
plt.xlabel('Year')
plt.ylabel('Cumulative Adopters')
plt.legend()
plt.show()

# Display the estimated parameters
print(f"Estimated p: {p_est}")
print(f"Estimated q: {q_est}")
print(f"Estimated m: {m_est}")
```




```
Estimated p: 0.01
Estimated q: 0.1
Estimated m: 95.23124998712046
```

The Bass model has three parameters:

p: The innovation coefficient, which represents the probability that a potential customer will adopt the new product because of innovation.

q: The imitation coefficient, which represents the probability that a potential customer will adopt the new product because of imitation.

m: The market potential, which represents the maximum number of potential customers for the new product.

5. Make predictions of the diffusion of the innovation you chose at stage 1

In [ ]:
```
#  Bass Model equation
def bass_model(t, p, q, m):
    return m * (1 - np.exp(-(p+q)*t)) / (1 + (q/p) * np.exp(-(p+q)*t))

# Estimated Bass Model parameters
p_estimated = 0.01
q_estimated = 0.1
m_estimated = 95.23124998712046

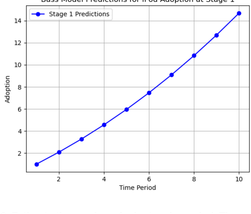
# Time period (10 years for Stage 1)
t_stage1 = np.arange(1, 11)

# Predict the adoption at Stage 1 for each time period
adoption_stage1 = [bass_model(t, p_estimated, q_estimated, m_estimated) for t in t_stage1]
```

Plot the predictions

In [ ]:
```
import numpy as np
import matplotlib.pyplot as plt

plt.plot(t_stage1, adoption_stage1, marker='o', linestyle='-', color='b', label='Stage 1 Predictions')
plt.xlabel('Time Period')
plt.ylabel('Adoption')
plt.title('Bass Model Predictions for iPod Adoption at Stage 1')
plt.legend()
plt.grid(True)
plt.show()
```



6. Estimate the number of adopters by period. Thus, you will need to estimate the potential market share. You can use Fermi's logic here as well.

In [ ]:
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# Potential market size estimation using Fermi's logic
# Assume an annual growth rate of potential market size 10%
annual_growth_rate = 0.10
potential_market_sizes = [m_estimated * (1 + annual_growth_rate)**t for t in t_stage1]

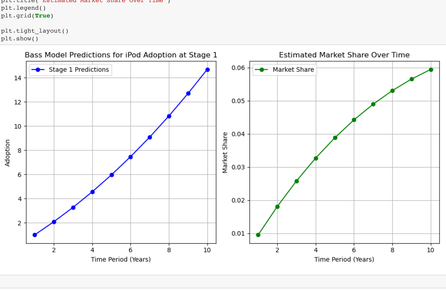
# Calculate the number of adopters by period
adopters_by_period = [adoption_stage1[t] for t in range(len(t_stage1))]

# Calculate potential market share for each period
potential_market_share = [adopters / potential_market_sizes[t] for t, adopters in enumerate(adopters_by_period)]

# Plot the predictions and market share
plt.figure(figsize=(10, 5))
plt.subplot(1, 2, 1)
plt.plot(t_stage1, adoption_stage1, marker='o', linestyle='-', color='b', label='Stage 1 Predictions')
plt.xlabel('Time Period (Years)')
plt.ylabel('Adoption')
plt.title('Bass Model Predictions for iPod Adoption at Stage 1')
plt.legend()
plt.grid(True)

plt.subplot(1, 2, 2)
plt.plot(t_stage1, potential_market_share, marker='o', linestyle='-', color='g', label='Market Share')
plt.xlabel('Time Period (Years)')
plt.ylabel('Market Share')
plt.title('Estimated Market Share Over Time')
plt.legend()
plt.grid(True)

plt.tight_layout()
plt.show()
```



In [ ]:
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