

Sleep Recommendation System

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Abstract - “Sleep Hygiene”, A buzzword in the era of Smart Technologies, fast pacing lifestyle and an ever-expanding demand of work. This paper discusses a solution for those who suffer sleep depravity, sleep Apnea, Insomnia or are just looking to perform better at work which they can’t due to lack of sleep last night. Adopting the widely used recommendation system technologies that you see on Netflix, amazon, Instagram or Twitch can also be used to improve our Health, our sleep or the Sleep Hygiene that we talk so much about. This Paper also includes the review of how our sleep quality is impacted by the habits that we follow and environmental factors which surround us such as Eating Habits, Exercising, Noise Exposure and Screen Timing. Then onward determining the conscious choice of action towards modifying those habits so they come to our benefit. Designing an intelligent system which would drive itself to help you go through the day with minimum impact from the activities that may cause you sleeplessness at night and a smart alarm that detects your sleep phases and wakes you up with least amount of resistance.

I.INTRODUCTION

A recommender system or Engine is an information filtering process which seeks to ‘predict’ the rating a user would give to an item. Our choices and preferences today are displayed to us without us actively searching for them this has all become possible due to our internet footprint, every moment we are generating a lot of data, signaling our choices and preferences. Such similar footprints also exist in our daily life. In the form of actions that we do, the vitals that our body show, events that happen in our surrounding and the environmental factors. These unnoticed factors scream towards a solution that should be adopted to impact the worsening lifestyles of individuals. Author has attempted to create a solution where the most preferable options are recommended to the user based on lifestyle structure, environmental influences, vitals of the

body and other enveloping information related direct to a person’s sleep hygiene, medical history and personal overall health.

In most recommendation Engines the Biggest problem is “cold start problem”. Recommending anything to a new user and recommending anything new to any user. Although these drawbacks are partially filled by randomly recommending new items to random users (Random strategy), recommending popular items to highly active users (maximum expectation strategy) and lastly using a non-collaborative method in the beginning. None fills the gap better than a supervised learning model where all new users are tested against an existing model created from study at thousands of volunteers to record their sleeping patters. This data was made available through NSRR for research purpose and platform building.

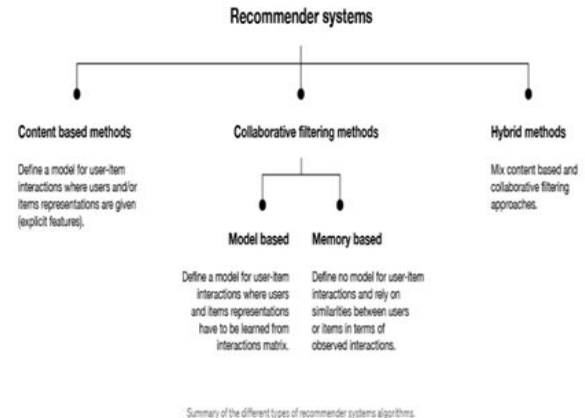


Fig:1.1 Recommendation system algorithm summary “The Wisconsin Sleep Cohort (WSC) is an ongoing longitudinal study of the causes, consequences, and natural history of sleep disorders, particularly sleep apnea. The WSC uses overnight in-laboratory sleep studies (in-patient studies at the University of Wisconsin - Madison ICTR’s CTRC) conducted with a baseline sample of 1,500 Wisconsin state employees, assessed at four-year intervals”.

II. PROPOSED WORK

1. Development of Interfacing platform.
 - a. Android Application
 - b. Web Application
2. Development and training of a supervised feedback ML model to test against sleeping patterns hidden in the records of NSRR sleep data.
3. Development of recommendations following research outcomes from recently published papers.
4. Implementing recommendations through application interface, and providing in app solution such as: Smart alarms, Bedtime melodies, stories, music, night routines, feet massage, oil pulling, yoga-nidra



Fig2.1 Application model for SRS

IV. REVIEW SURVEY

Hectic lifestyle and stressful work schedules have led to a linearly reduction in the number of hours that people sleep and this pattern is seen amongst working employees who complain about their poor health without even realizing that inadequate sleep is the main culprit. On an average basis, sleeping for 7-8 hours a day is consider as good night sleep. It is as essential as other daily basis amenities like, food, water, and oxygen, sleep too plays a very important role in the existence of life. Sleep deprivation, also known as insufficient sleep or sleeplessness, is the condition of not having enough sleep or lack of sleep and so many disease-like cardiac problems, obesity and even early demise come with it.

Phases of Sleep Cycle: -

Sleep has been traditionally divided into two

Categories: Non-rapid eye movement (NREM) and rapid eye movement (REM).

1. Phase 0: Wake Up Stage
2. Phase 1 & 2 are light sleep phases with some wake up tendency.
3. Phase 3 & 4: Deep Sleep or good night sleep.
4. Phase R: REM Sleep.

Habits that affect Sleep: -

1. Consumption of Caffeine: - It is observed that intake of Caffeine products like tea, coffee just before bed time will result into delay in sleep or lack of good quality sleep.
2. Usage of Technology: - Craze of using mobile phones, laptops consume huge amount of time during bed time which doesn't lead person to sleep less than average hours.
3. Sleeping at peculiar hours: - Sleep in irregular time frame, odd hours leads to sleep deprivation.
4. Eating before Sleep time: - After eating, body will process to digest the food rather than relaxing itself for a good night sleep.

V. VITALS USED TO MONITOR SLEEP

1. Polysomnography test: - Polysomnography is the clinically proven test for diagnosing sleep disorder under medical Setting. It is the test which includes sensors that attached with the patient's body.
2. Mobile Health and Wellness Systems: - There are multiple wearable sleep sensors such as Fit Bit, Wake Mate, and Jawbone capture the sleep patterns, how sleep get affected with change in environmental factors available in bedroom like lights, wake up moments etc. Basically, captures every moment while person sleep and determine how good the quality of sleep is.
3. RF-based Breathing Rate Monitors: - Prior RF-based approaches record changes in radio signals to estimate the breathing frequency while sleeping using a network of 2.4 GHz wireless sensors in the bedroom.

VI.INFERENCES DRAWN FROM LITERATURE

Some tests to test sleep quality already exists- EEG, PSG tests- but they require a sensor network. Hence, not feasible for everyday use.

The concept behind these tests- recording breathing pattern during sleep. A smartphone can be used for the same.

Hence, our project uses smartphone as a device to record breathing pattern using the phone's microphone.

Make it feasible and easily accessible for everyday use.

Smart Alarms: - Alarm clocks prove to be good resource to regularize sleep pattern. Waking up around the same time each day is beneficial for our health. Using an alarm clock can help keep your schedule consistent and normalize your sleep patterns.

Nighttime Melodies: - Music has many promising effects on human neural system like lullaby or light soothing music helps body to fight against all odds like anxiety, lack of sleep.

Screen Time of User: - Increase in screen time leads to delay in bed time equivalent to less hours of sleep and its deprivation. Avoidance of tech products leads to good amount of sleep.

Exercising Effect and sound exposure: - Exercise keeps human body fit, improves quality as well as duration of sleep and decrease wake up moments.

Minimum sound exposure in bedroom increases the duration of sleep. Noise exposure is inversely proportion to good quality sleep.

VII.CONCLUSION

1. Supervised learning model with pre-processing data outperforms Random Strategy, Maximum expectation model and non-collaborative approach.
2. Different sleep Score like HO (horn-osburg) score helps people to customize their day by shifting their peak alertness.
3. Recommendation system employed in daily activity can be extended to patients in intensive care and for monitoring other critical issues.

4. Apex Score utilized with feedback variance machine could significantly increase the accuracy of recommendation system.

$$Apdex_t = \frac{SatisfiedCount + \frac{ToleratingCount}{2}}{TotalSamples}$$

Fig. 7.1 Formula to calculate apdex

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