

Chapter 41

Comparative Study of Various Machine Learning Algorithms for Prediction of Insomnia

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ABSTRACT

An early diagnosis of insomnia can prevent further medical aids such as anger issues, heart diseases, anxiety, depression, and hypertension. Fifteen machine learning algorithms have been applied and 14 leading factors have been taken into consideration for predicting insomnia. Seven performance parameters (accuracy, kappa, the true positive rate, false positive rate, precision, f-measure, and AUC) are used and for implementation. The authors have used python language. The support vector machine is giving higher performance out of all algorithms giving accuracy 91.6%, f-measure is 92.13, and kappa is 0.83. Further, SVM is applied on another dataset of 100 patients and giving accuracy 92%. In addition, an analysis of the variable importance of CART, C5.0, decision tree, random forest, adaptive boost, and XG boost is calculated. The analysis shows that insomnia primarily depends on the factors, which are the vision problem, mobility problem, and sleep disorder. This chapter mainly finds the usages and effectiveness of machine learning algorithms in Insomnia diseases prediction.

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INTRODUCTION

Insomnia is a subjective complaint of sleep disorder in which the patient has a difficulty to fall asleep or remain sleeping as long as desired. Insomniac usually have low energy, less concentrating power, less appetite, and mood swings, leading to low performance throughout the day at work (Mulaffer, Shahin, Glos, Penzel & Ahmed, 2017). Insomnia is mainly categorized into the following types on the basis of duration of disturbed sleep timings (Chouvarda et al., 2013): (i) Acute Insomnia: It prevails for a short duration of time (Maximum for a month). The main cause for its existence could be bizarre life events such as a stressful environment at work, jet lags due to traveling or existence of a certain problem at home. This does not require severe medical treatment and can be cured by general meditation (National Sleep Foundation, n.d; Saddichha, 2010) (ii) Chronic Insomnia: A person is said to be facing chronic insomnia if he/she suffers from a disturbed sleep more than 3 days a week and continuously for 3 or more months. The main causes are depression, anxiety, chronic stress, and pain or discomfort at night. Often it requires behavioral therapies; sleep restriction therapies, relaxation exercises and reconditioning for its cure (Zhang, Mo & Zhang, 2017) and, (iii) Comorbid Insomnia: It is also known as secondary insomnia. It is said to prevail when a person faces insomnia due to medical or psychiatric conditions or intake of drugs. Treatment of comorbid insomnia is done by separately treating insomnia and the comorbid mental illness. Treatment and medication are suggested by the psychiatrist (Hu, 2017; Neikrug, 2010; Skaer, 2018).

According to Global health and an aging report presented by WHO in 2016, it was reported that the population of people with age group 65 or more was 524 million in 2010 which counts nearly 8.5% and is expected to increase up to 1.6 billion till 2050 that is 17% of the total population (“Global health aging”, n.d). In America, it is projected that the population with age group 65 or above will nearly double over 3 decades that is 48 million to 88 million by 2050. The global population of elderly people (age 80 or above) is expected to be three times higher during 2015 and 2050 as estimated by the national institute of aging (United Nations, 2010). In India, the increase in decrepit patients rose from about 7% in 2000 to 9% in 2015.

Comparing the data of the previous 35 years, we find that each year the percentage of elderly people is increasing linearly around the globe, in India too we see a similar trend in the increase of the population of elderly patients. According to a survey of 1.1 million Individuals, people who sleep between 6.5 to 7.5 hours a day have been found to have the least mortality rate; whereas those who sleep under 6 hours or above 8 hours are found to have higher mortality rates (Kinsella, 2009; “Global health aging” n.d). Although till date it is not clear why sleeping more than 7.5 hours is associated with higher mortality (Banno & Kryger, 2006). According to research by the National Center for Biotechnology information, 50% of decrepit patients generally complain about deprived sleep, not just due to increased aging; but also due to factors like increased medication, stressful life, etc. These above-mentioned mortality factors can be responsible for insomnia, either is it acute, chronic or comorbid insomnia. Studies show that around 1 out of 3 people face either of the symptoms of insomnia. Owing to the seriousness of the situation, The American Academy of Sleep Medicine has declared Insomnia Awareness Day on March 12, 2018 (American Academy of Sleep Medicine, n.d).

The National Sleep Foundation, in 2005, carried a survey on American population and reported that 76% of the decrepit population thinks that they have a sleep problem. Surveys also reveal that nearly 70% of population experience at least one symptom of insomnia (“Sleep findings data” n.d)(Waking up too early, inconsistent sleep, Difficulty falling asleep, Tension, Headache, Unhealthy stomach and

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