SIMATS ENGINEERING
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TECH STAR SUMMIT 2024
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Improving Accuracy in Sleep Cycle Prediction Using Support Vector Machine Algorithm Compared to Random Forest Algorithm

INTRODUCTION

- Sleep is an essential aspect of human physiology, and has a profound impact on overall health, cognitive function, and emotional well-being.
- Sleep loss affects every major system in the human body. Chronic changes in sleep have been associated with a plethora of serious medical problems from obesity and diabetes to neuropsychiatric disorders.
- In this study, we aim to evaluate the sleep cycle using algorithms like Random Forest (RF) and Support Vector Machine (SVM) by utilizing a diverse range of data sources, such as wearable devices, physiological sensors, and self-reported sleep logs.
- Here, By collecting comprehensive data over an extended period, we seek to identify patterns and trends that correlate with different sleep stages, including light sleep, and deep sleep.
- By providing individuals with insights into their sleep patterns and suggesting actionable recommendations, such as adjusting bedtime routines or environmental conditions, we can empower them to make informed decisions to improve their sleep quality and overall well-being.

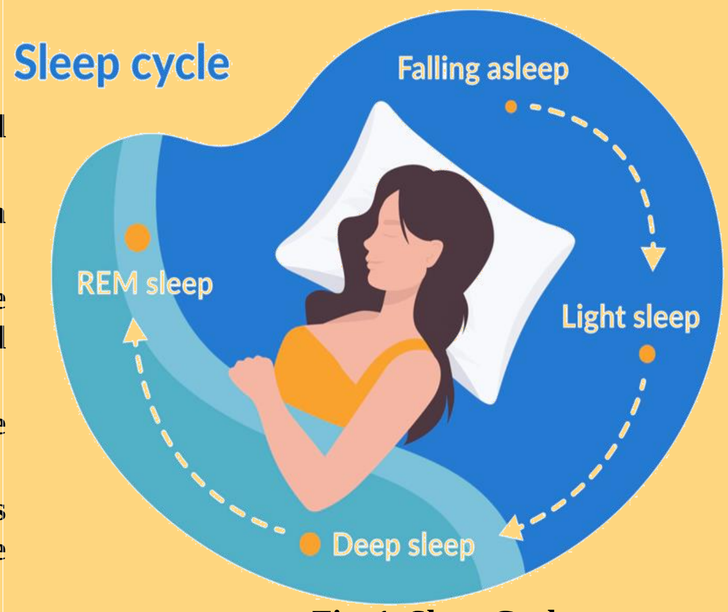
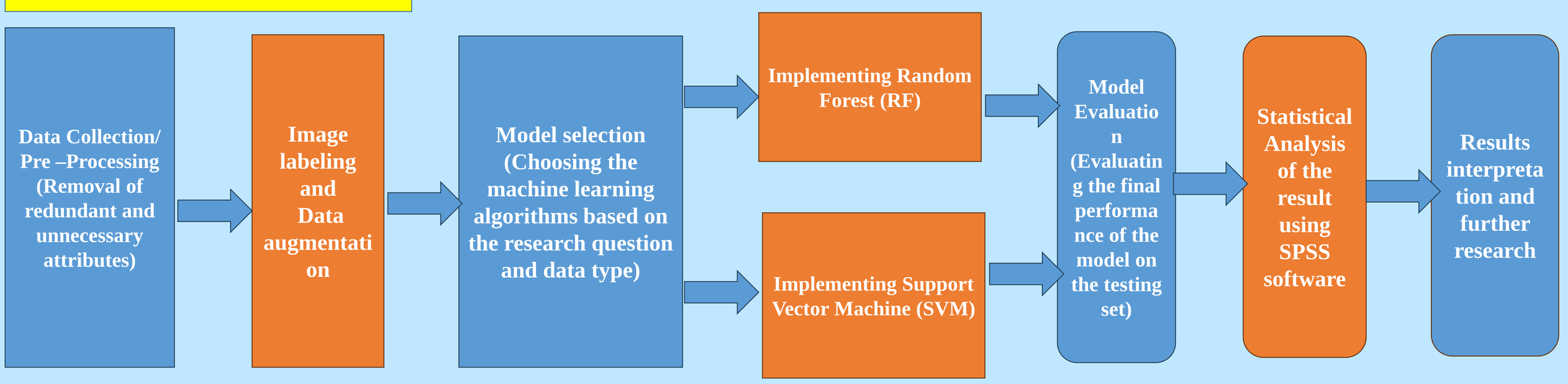


Fig. 1. Sleep Cycle

MATERIALS AND METHODS



RESULTS

Table 1: Independent Sample Test for significance and standard error determination. P-value is less than 0.05

		Levine's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	D f	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
ACCURACY	Equal variances assumed	.551	.467	8.158	18	.000	8.29200	1.01644	6.15654	10.42746
	Equal variances not assumed			8.158	16.635	.000	8.29200	1.01644	6.14391	10.44009

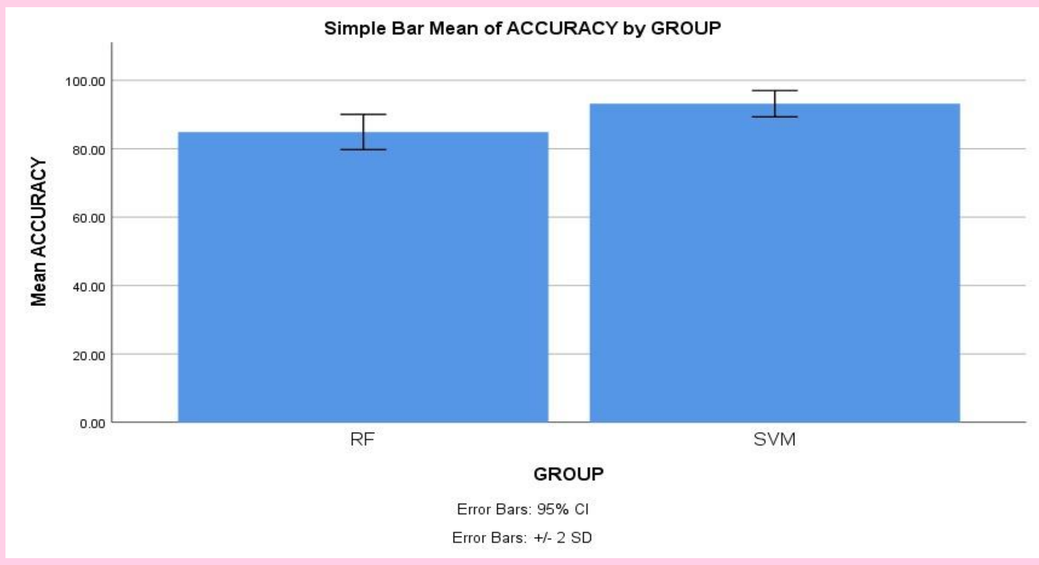


Fig. 2. An SPSS graph showing the comparison of accuracy between RF and SVM Algorithm.

DISCUSSION AND CONCLUSION

- According to the T-test, the results of the statistical analysis showed that there was a significant difference between groups 1 and 2, with a p-value of $p<0.05$ (independent sample T-test).
- The SVM algorithm exhibited commendable performance achieving an accuracy rate of 93.17% in predicting sleep patterns, while the accuracy of the RF algorithm was noted to be 84.88%.
- One limitation of using a SVM algorithm for sleep cycle prediction is its interpretability. While SVMs excel at finding complex patterns in data, understanding the logic behind those patterns can be challenging. This lack of interpretability makes it difficult to pinpoint why the SVM predicts a certain sleep stage and hinders the ability to improve the model based on these insights.
- Additionally, future studies integrating artificial intelligence techniques and visualization methods into the SVM model could help to elucidate the decision-making process and improve the understandability of the model's predictions.

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