

Supplementary Materials

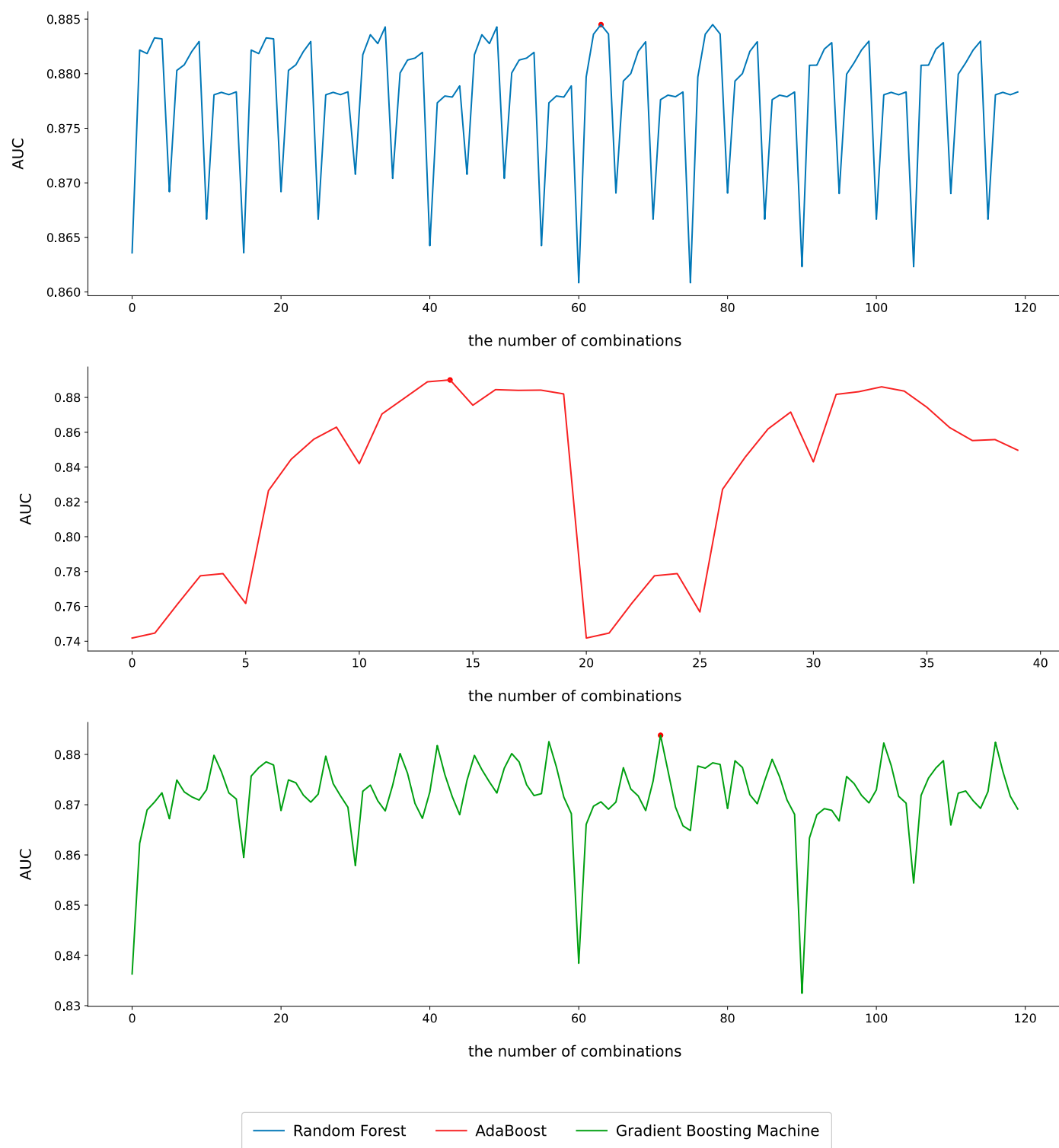


Figure S1. Machine Learning Curve for each best models using Grid search method; Random Forest, AdaBoost and Gradient Boosting Machine. A red dot indicates the combinations of hyperparameters that result in the best performance of each model.

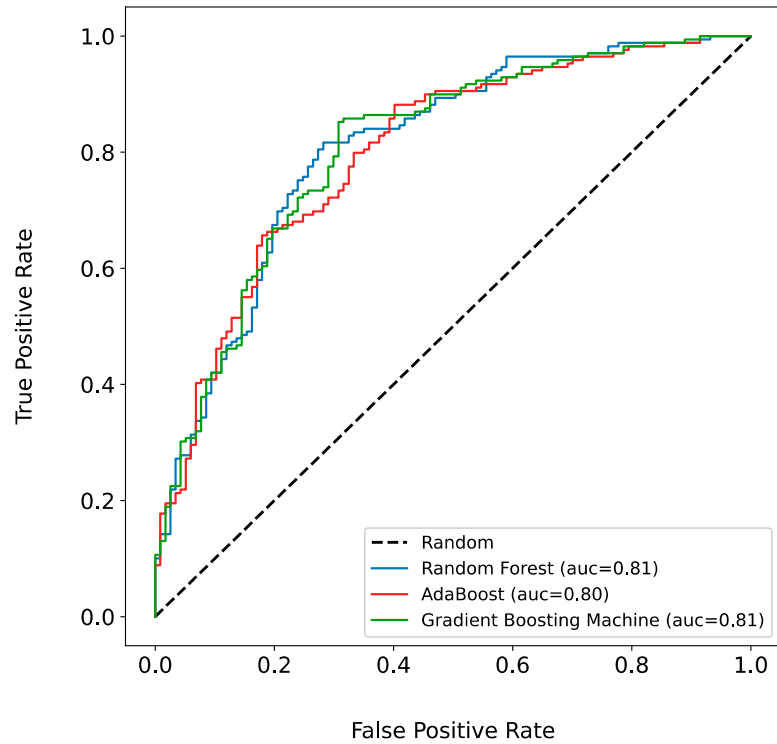


Figure S2. ROC (Receiver Operating Characteristic) Curve for three different best models (Random Forest, AdaBoost and Gradient Boosting Machine) based on 10 selected Checkup features.

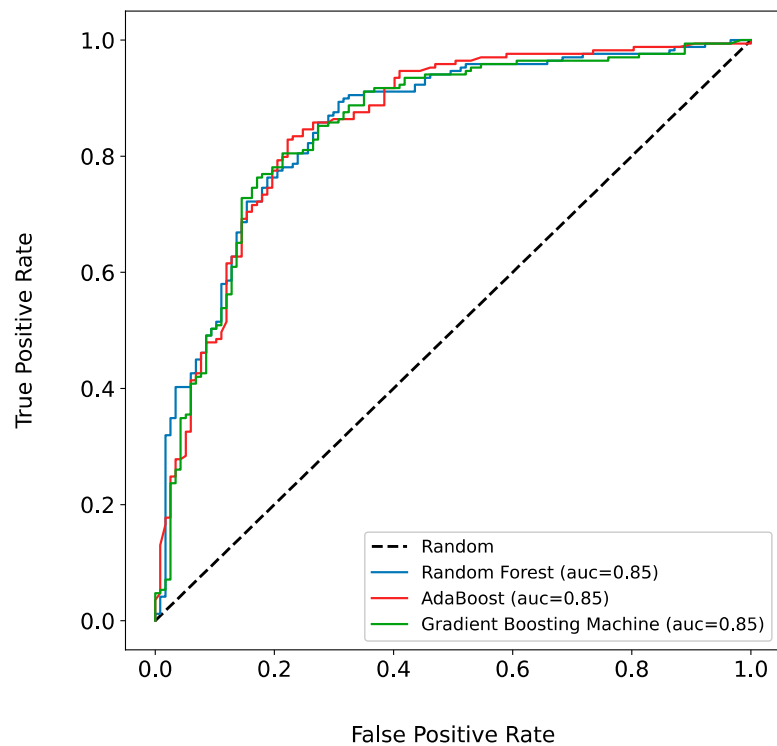


Figure S3. ROC (Receiver Operating Characteristic) Curve for three different best models (Random Forest, AdaBoost and Gradient Boosting Machine) based on 10 selected Survey features.

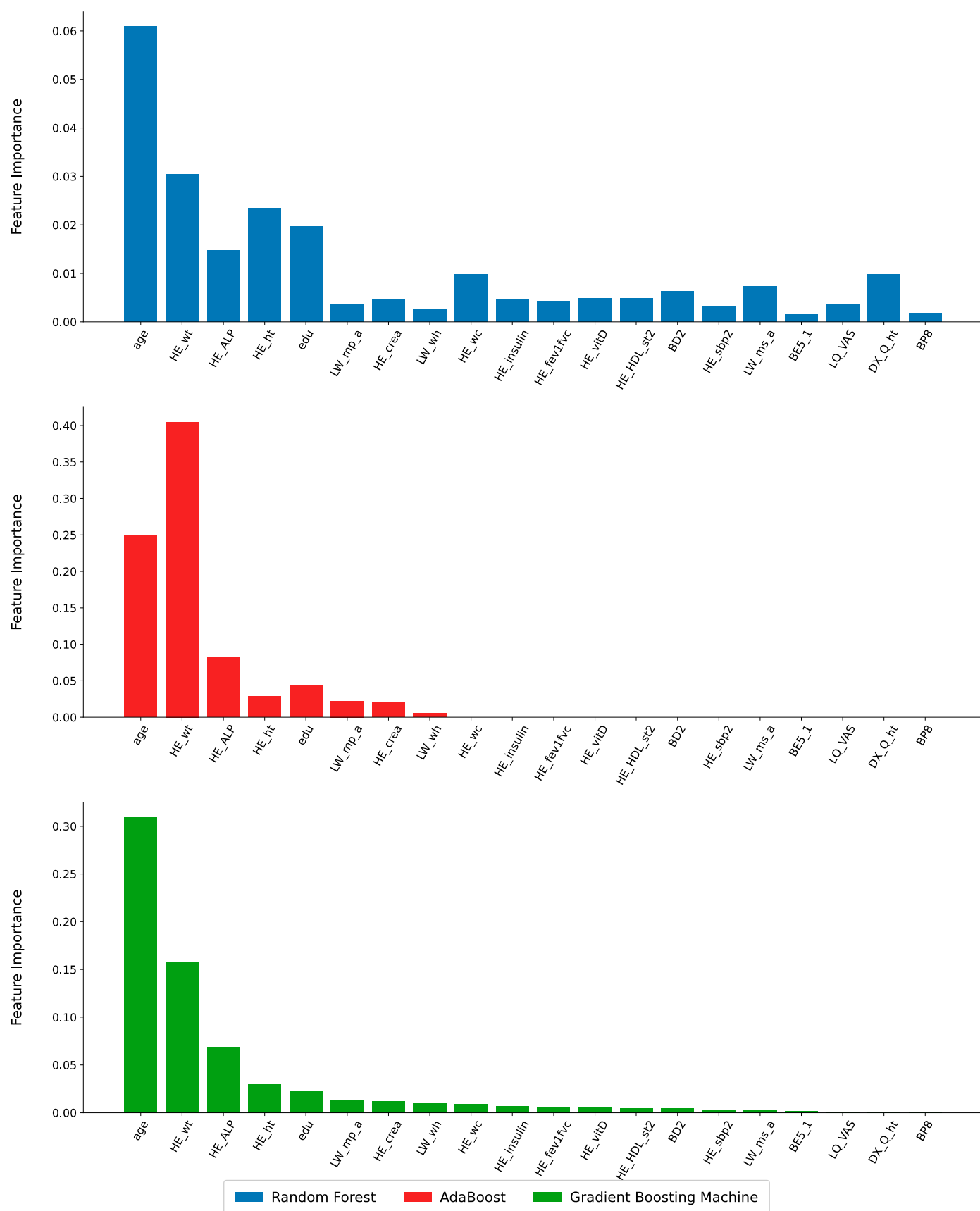


Figure S4. Feature importance bar graph for 20 features measured by three different ensemble machine learning models (Random Forest, AdaBoost and Gradient Boosting Machine).

Table S1. The number of normal and osteoporosis patients distributed in women

Age range	0 ~ 39	40 ~ 49	50 ~ 59	60 ~ 69	70 ~ 79	Over 80
Normal	7	84	391	135	27	1
Osteoporosis	0	11	222	588	697	<u>232</u>

Table S2. Summary of the Model C's Performances on the test set (N =287).

Model	Accuracy	Precision	Recall	AUC
Random Forest	0.832	0.833	0.893	0.919
AdaBoost	0.849	0.849	0.905	<u>0.921</u>
Gradient Boosting	0.829	0.844	0.869	0.908

* Top performing model is underlined. AUC: Area Under the Curve. GBM: Gradient Boosting Machine