|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Supplemental Table 2 Performanc of the ML models in cross-validation in the FAHFUM sub-cohort | | | | | |
|  | | AUC (95% CI) | Accuracy (95% CI) | Sensitivity (95% CI) | Specificity (95% CI) |
| Split 1 | | | | | |
| LR | Fold 1 | 0.880 (0.801,0.959) | 0.800 (0.703,0.897) | 0.714 (0.604,0.824) | 0.841 (0.752,0.930) |
|  | Fold 2 | 0.916 (0.848,0.983) | 0.908 (0.837,0.978) | 0.875 (0.795,0.955) | 0.918 (0.852,0.985) |
|  | Fold 3 | 0.791 (0.692,0.890) | 0.785 (0.685,0.885) | 0.524 (0.402,0.645) | 0.909 (0.839,0.979) |
|  | Fold 4 | 0.962 (0.916,1.000) | 0.877 (0.797,0.957) | 0.588 (0.469,0.708) | 0.979 (0.944,1.000) |
|  | Fold 5 | 0.834 (0.743,0.925) | 0.781 (0.680,0.883) | 0.500 (0.378,0.623) | 0.929 (0.865,0.992) |
| GNB | Fold 1 | 0.857 (0.771,0.942) | 0.831 (0.740,0.922) | 0.619 (0.501,0.737) | 0.932 (0.871,0.993) |
|  | Fold 2 | 0.909 (0.840,0.979) | 0.892 (0.817,0.968) | 0.750 (0.645,0.855) | 0.939 (0.880,0.997) |
|  | Fold 3 | 0.798 (0.700,0.895) | 0.785 (0.685,0.885) | 0.619 (0.501,0.737) | 0.864 (0.780,0.947) |
|  | Fold 4 | 0.956 (0.906,1.000) | 0.862 (0.778,0.946) | 0.588 (0.469,0.708) | 0.958 (0.910,1.000) |
|  | Fold 5 | 0.830 (0.737,0.922) | 0.766 (0.662,0.869) | 0.455 (0.333,0.577) | 0.929 (0.865,0.992) |
| RF | Fold 1 | 0.878 (0.798,0.957) | 0.815 (0.721,0.910) | 0.714 (0.604,0.824) | 0.864 (0.780,0.947) |
|  | Fold 2 | 0.908 (0.838,0.978) | 0.877 (0.797,0.957) | 0.625 (0.507,0.743) | 0.959 (0.911,1.000) |
|  | Fold 3 | 0.806 (0.710,0.902) | 0.738 (0.632,0.845) | 0.381 (0.263,0.499) | 0.909 (0.839,0.979) |
|  | Fold 4 | 0.947 (0.892,1.000) | 0.846 (0.758,0.934) | 0.529 (0.408,0.651) | 0.958 (0.910,1.000) |
|  | Fold 5 | 0.846 (0.758,0.935) | 0.766 (0.662,0.869) | 0.409 (0.289,0.530) | 0.952 (0.900,1.000) |
| KNN | Fold 1 | 0.846 (0.759,0.934) | 0.831 (0.740,0.922) | 0.571 (0.451,0.692) | 0.955 (0.904,1.000) |
|  | Fold 2 | 0.888 (0.812,0.965) | 0.892 (0.817,0.968) | 0.750 (0.645,0.855) | 0.939 (0.880,0.997) |
|  | Fold 3 | 0.734 (0.626,0.841) | 0.692 (0.580,0.805) | 0.333 (0.219,0.448) | 0.864 (0.780,0.947) |
|  | Fold 4 | 0.888 (0.811,0.965) | 0.815 (0.721,0.910) | 0.412 (0.292,0.531) | 0.958 (0.910,1.000) |
|  | Fold 5 | 0.696 (0.583,0.809) | 0.750 (0.644,0.856) | 0.364 (0.246,0.481) | 0.952 (0.900,1.000) |
| SVM | Fold 1 | 0.758 (0.654,0.862) | 0.754 (0.649,0.859) | 0.667 (0.552,0.781) | 0.795 (0.697,0.894) |
|  | Fold 2 | 0.884 (0.806,0.962) | 0.846 (0.758,0.934) | 0.688 (0.575,0.800) | 0.898 (0.824,0.972) |
|  | Fold 3 | 0.703 (0.592,0.814) | 0.708 (0.597,0.818) | 0.429 (0.308,0.549) | 0.841 (0.752,0.930) |
|  | Fold 4 | 0.784 (0.684,0.884) | 0.815 (0.721,0.910) | 0.412 (0.292,0.531) | 0.958 (0.910,1.000) |
|  | Fold 5 | 0.767 (0.664,0.871) | 0.703 (0.591,0.815) | 0.227 (0.125,0.330) | 0.952 (0.900,1.000) |
| XGB | Fold 1 | 0.825 (0.733,0.918) | 0.769 (0.667,0.872) | 0.714 (0.604,0.824) | 0.795 (0.697,0.894) |
|  | Fold 2 | 0.897 (0.824,0.971) | 0.862 (0.778,0.946) | 0.812 (0.718,0.907) | 0.878 (0.798,0.957) |
|  | Fold 3 | 0.794 (0.695,0.892) | 0.754 (0.649,0.859) | 0.524 (0.402,0.645) | 0.864 (0.780,0.947) |
|  | Fold 4 | 0.939 (0.881,0.997) | 0.846 (0.758,0.934) | 0.765 (0.662,0.868) | 0.875 (0.795,0.955) |
|  | Fold 5 | 0.826 (0.733,0.919) | 0.766 (0.662,0.869) | 0.409 (0.289,0.530) | 0.952 (0.900,1.000) |
| ESVM | Fold 1 | 0.855 (0.769,0.941) | 0.846 (0.758,0.934) | 0.714 (0.604,0.824) | 0.909 (0.839,0.979) |
|  | Fold 2 | 0.916 (0.848,0.983) | 0.908 (0.837,0.978) | 0.812 (0.718,0.907) | 0.939 (0.880,0.997) |
|  | Fold 3 | 0.800 (0.703,0.897) | 0.785 (0.685,0.885) | 0.524 (0.402,0.645) | 0.909 (0.839,0.979) |
|  | Fold 4 | 0.940 (0.882,0.998) | 0.862 (0.778,0.946) | 0.588 (0.469,0.708) | 0.958 (0.910,1.000) |
|  | Fold 5 | 0.821 (0.727,0.915) | 0.781 (0.680,0.883) | 0.500 (0.378,0.623) | 0.929 (0.865,0.992) |
| Split 2 | | | | | |
| LR | Fold 1 | 0.825 (0.732,0.917) | 0.769 (0.667,0.872) | 0.706 (0.595,0.817) | 0.792 (0.693,0.890) |
|  | Fold 2 | 0.871 (0.789,0.952) | 0.846 (0.758,0.934) | 0.500 (0.378,0.622) | 1.000 (1.000,1.000) |
|  | Fold 3 | 0.894 (0.820,0.969) | 0.815 (0.721,0.910) | 0.682 (0.569,0.795) | 0.884 (0.806,0.962) |
|  | Fold 4 | 0.848 (0.760,0.935) | 0.800 (0.703,0.897) | 0.556 (0.435,0.676) | 0.894 (0.819,0.969) |
|  | Fold 5 | 0.864 (0.780,0.948) | 0.828 (0.736,0.921) | 0.600 (0.480,0.720) | 0.932 (0.870,0.994) |
| GNB | Fold 1 | 0.855 (0.770,0.941) | 0.769 (0.667,0.872) | 0.588 (0.469,0.708) | 0.833 (0.743,0.924) |
|  | Fold 2 | 0.909 (0.840,0.979) | 0.862 (0.778,0.946) | 0.600 (0.481,0.719) | 0.978 (0.942,1.000) |
|  | Fold 3 | 0.903 (0.831,0.975) | 0.862 (0.778,0.946) | 0.682 (0.569,0.795) | 0.953 (0.902,1.000) |
|  | Fold 4 | 0.839 (0.750,0.929) | 0.815 (0.721,0.910) | 0.556 (0.435,0.676) | 0.915 (0.847,0.983) |
|  | Fold 5 | 0.854 (0.767,0.940) | 0.797 (0.698,0.895) | 0.550 (0.428,0.672) | 0.909 (0.839,0.980) |
| RF | Fold 1 | 0.860 (0.776,0.945) | 0.815 (0.721,0.910) | 0.647 (0.531,0.763) | 0.875 (0.795,0.955) |
|  | Fold 2 | 0.877 (0.797,0.957) | 0.846 (0.758,0.934) | 0.500 (0.378,0.622) | 1.000 (1.000,1.000) |
|  | Fold 3 | 0.882 (0.804,0.961) | 0.846 (0.758,0.934) | 0.591 (0.471,0.710) | 0.977 (0.940,1.000) |
|  | Fold 4 | 0.838 (0.749,0.928) | 0.800 (0.703,0.897) | 0.667 (0.552,0.781) | 0.851 (0.765,0.938) |
|  | Fold 5 | 0.876 (0.795,0.956) | 0.828 (0.736,0.921) | 0.550 (0.428,0.672) | 0.955 (0.904,1.000) |
| KNN | Fold 1 | 0.759 (0.655,0.863) | 0.769 (0.667,0.872) | 0.529 (0.408,0.651) | 0.854 (0.768,0.940) |
|  | Fold 2 | 0.818 (0.724,0.912) | 0.815 (0.721,0.910) | 0.500 (0.378,0.622) | 0.956 (0.905,1.000) |
|  | Fold 3 | 0.799 (0.701,0.896) | 0.708 (0.597,0.818) | 0.455 (0.333,0.576) | 0.837 (0.747,0.927) |
|  | Fold 4 | 0.766 (0.663,0.869) | 0.723 (0.614,0.832) | 0.333 (0.219,0.448) | 0.872 (0.791,0.953) |
|  | Fold 5 | 0.820 (0.726,0.914) | 0.812 (0.717,0.908) | 0.500 (0.378,0.623) | 0.955 (0.904,1.000) |
| SVM | Fold 1 | 0.815 (0.721,0.909) | 0.800 (0.703,0.897) | 0.706 (0.595,0.817) | 0.833 (0.743,0.924) |
|  | Fold 2 | 0.892 (0.816,0.967) | 0.831 (0.740,0.922) | 0.500 (0.378,0.622) | 0.978 (0.942,1.000) |
|  | Fold 3 | 0.830 (0.738,0.921) | 0.846 (0.758,0.934) | 0.727 (0.619,0.836) | 0.907 (0.836,0.978) |
|  | Fold 4 | 0.699 (0.587,0.810) | 0.769 (0.667,0.872) | 0.500 (0.378,0.622) | 0.872 (0.791,0.953) |
|  | Fold 5 | 0.855 (0.768,0.941) | 0.828 (0.736,0.921) | 0.650 (0.533,0.767) | 0.909 (0.839,0.980) |
| XGB | Fold 1 | 0.853 (0.767,0.939) | 0.754 (0.649,0.859) | 0.706 (0.595,0.817) | 0.771 (0.669,0.873) |
|  | Fold 2 | 0.884 (0.806,0.962) | 0.877 (0.797,0.957) | 0.700 (0.589,0.811) | 0.956 (0.905,1.000) |
|  | Fold 3 | 0.871 (0.789,0.952) | 0.769 (0.667,0.872) | 0.636 (0.519,0.753) | 0.837 (0.747,0.927) |
|  | Fold 4 | 0.827 (0.735,0.919) | 0.785 (0.685,0.885) | 0.611 (0.493,0.730) | 0.851 (0.765,0.938) |
|  | Fold 5 | 0.866 (0.783,0.950) | 0.797 (0.698,0.895) | 0.750 (0.644,0.856) | 0.818 (0.724,0.913) |
| ESVM | Fold 1 | 0.841 (0.752,0.930) | 0.815 (0.721,0.910) | 0.647 (0.531,0.763) | 0.875 (0.795,0.955) |
|  | Fold 2 | 0.901 (0.828,0.973) | 0.846 (0.758,0.934) | 0.550 (0.429,0.671) | 0.978 (0.942,1.014) |
|  | Fold 3 | 0.885 (0.807,0.962) | 0.877 (0.797,0.957) | 0.727 (0.619,0.836) | 0.953 (0.902,1.000) |
|  | Fold 4 | 0.836 (0.746,0.926) | 0.800 (0.703,0.897) | 0.500 (0.378,0.622) | 0.915 (0.847,0.983) |
|  | Fold 5 | 0.868 (0.785,0.951) | 0.828 (0.736,0.921) | 0.600 (0.480,0.720) | 0.932 (0.870,0.994) |
| Spit 3 | | | | | |
| LR | Fold 1 | 0.839 (0.750,0.929) | 0.785 (0.685,0.885) | 0.611 (0.493,0.730) | 0.851 (0.765,0.938) |
|  | Fold 2 | 0.894 (0.820,0.969) | 0.877 (0.797,0.957) | 0.739 (0.632,0.846) | 0.952 (0.901,1.000) |
|  | Fold 3 | 0.864 (0.781,0.948) | 0.785 (0.685,0.885) | 0.522 (0.400,0.643) | 0.929 (0.866,0.991) |
|  | Fold 4 | 0.887 (0.809,0.964) | 0.846 (0.758,0.934) | 0.571 (0.451,0.692) | 0.922 (0.856,0.987) |
|  | Fold 5 | 0.856 (0.770,0.942) | 0.828 (0.736,0.921) | 0.579 (0.458,0.700) | 0.933 (0.872,0.994) |
| GNB | Fold 1 | 0.855 (0.769,0.940) | 0.846 (0.758,0.934) | 0.611 (0.493,0.730) | 0.936 (0.877,0.996) |
|  | Fold 2 | 0.906 (0.835,0.977) | 0.862 (0.778,0.946) | 0.739 (0.632,0.846) | 0.929 (0.866,0.991) |
|  | Fold 3 | 0.837 (0.748,0.927) | 0.754 (0.649,0.859) | 0.522 (0.400,0.643) | 0.881 (0.802,0.960) |
|  | Fold 4 | 0.898 (0.824,0.971) | 0.846 (0.758,0.934) | 0.571 (0.451,0.692) | 0.922 (0.856,0.987) |
|  | Fold 5 | 0.848 (0.760,0.936) | 0.797 (0.698,0.895) | 0.579 (0.458,0.700) | 0.889 (0.812,0.966) |
| RF | Fold 1 | 0.849 (0.762,0.936) | 0.846 (0.758,0.934) | 0.556 (0.435,0.676) | 0.957 (0.908,1.000) |
|  | Fold 2 | 0.895 (0.820,0.969) | 0.815 (0.721,0.910) | 0.609 (0.490,0.727) | 0.929 (0.866,0.991) |
|  | Fold 3 | 0.858 (0.773,0.943) | 0.754 (0.649,0.859) | 0.435 (0.314,0.555) | 0.929 (0.866,0.991) |
|  | Fold 4 | 0.891 (0.816,0.967) | 0.846 (0.758,0.934) | 0.429 (0.308,0.549) | 0.961 (0.914,1.000) |
|  | Fold 5 | 0.843 (0.754,0.932) | 0.844 (0.755,0.933) | 0.579 (0.458,0.700) | 0.956 (0.905,1.000) |
| KNN | Fold 1 | 0.839 (0.750,0.929) | 0.846 (0.758,0.934) | 0.667 (0.552,0.781) | 0.915 (0.847,0.983) |
|  | Fold 2 | 0.869 (0.787,0.951) | 0.723 (0.614,0.832) | 0.391 (0.273,0.510) | 0.905 (0.833,0.976) |
|  | Fold 3 | 0.763 (0.660,0.866) | 0.800 (0.703,0.897) | 0.522 (0.400,0.643) | 0.952 (0.901,1.000) |
|  | Fold 4 | 0.850 (0.763,0.937) | 0.815 (0.721,0.910) | 0.357 (0.241,0.474) | 0.941 (0.884,0.998) |
|  | Fold 5 | 0.830 (0.738,0.922) | 0.750 (0.644,0.856) | 0.421 (0.300,0.542) | 0.889 (0.812,0.966) |
| SVM | Fold 1 | 0.793 (0.695,0.892) | 0.815 (0.721,0.910) | 0.611 (0.493,0.730) | 0.894 (0.819,0.969) |
|  | Fold 2 | 0.883 (0.805,0.961) | 0.800 (0.703,0.897) | 0.609 (0.490,0.727) | 0.905 (0.833,0.976) |
|  | Fold 3 | 0.803 (0.707,0.900) | 0.800 (0.703,0.897) | 0.522 (0.400,0.643) | 0.952 (0.901,1.000) |
|  | Fold 4 | 0.814 (0.719,0.908) | 0.769 (0.667,0.872) | 0.429 (0.308,0.549) | 0.863 (0.779,0.946) |
|  | Fold 5 | 0.835 (0.744,0.926) | 0.859 (0.774,0.945) | 0.684 (0.570,0.798) | 0.933 (0.872,0.994) |
| XGB | Fold 1 | 0.778 (0.677,0.879) | 0.723 (0.614,0.832) | 0.444 (0.324,0.565) | 0.830 (0.738,0.921) |
|  | Fold 2 | 0.883 (0.804,0.961) | 0.846 (0.758,0.934) | 0.826 (0.734,0.918) | 0.857 (0.772,0.942) |
|  | Fold 3 | 0.833 (0.742,0.924) | 0.800 (0.703,0.897) | 0.609 (0.490,0.727) | 0.905 (0.833,0.976) |
|  | Fold 4 | 0.875 (0.795,0.956) | 0.785 (0.685,0.885) | 0.571 (0.451,0.692) | 0.843 (0.755,0.932) |
|  | Fold 5 | 0.843 (0.753,0.932) | 0.812 (0.717,0.908) | 0.579 (0.458,0.700) | 0.911 (0.841,0.981) |
| ESVM | Fold 1 | 0.864 (0.781,0.947) | 0.831 (0.740,0.922) | 0.611 (0.493,0.730) | 0.915 (0.847,0.983) |
|  | Fold 2 | 0.906 (0.835,0.977) | 0.862 (0.778,0.946) | 0.739 (0.632,0.846) | 0.929 (0.866,0.991) |
|  | Fold 3 | 0.828 (0.736,0.920) | 0.800 (0.703,0.897) | 0.565 (0.445,0.686) | 0.929 (0.866,0.991) |
|  | Fold 4 | 0.889 (0.813,0.966) | 0.846 (0.758,0.934) | 0.571 (0.451,0.692) | 0.922 (0.856,0.987) |
|  | Fold 5 | 0.853 (0.766,0.939) | 0.844 (0.755,0.933) | 0.632 (0.513,0.750) | 0.933 (0.872,0.994) |
| ML: machine learning, AUC: the area under the curve, LR: Logistics Regression, GNB: Gaussian Naïve Bayes, RF: Random Forest, KNN: K-Nearest Neighbor, SVM: Support Vector Machine, XGB: EXtreme Gradient Boosting, ESVM: ensemble soft voting model. | | | | | |