



**Supplementary Fig. 1.** Least absolute shrinkage and selection operator (LASSO) cross-validation plot for optimal alpha selection. LASSO cross-validation plot showing the mean squared error (MSE) across different values of the regularization parameter,  $\log(\alpha)$ . The blue points represent the mean MSE, with error bars indicating the 95% confidence interval (CI). The optimal value of  $\alpha$  (0.0473) is indicated by the red dashed line, corresponding to the lowest MSE, which balances model complexity and predictive accuracy.