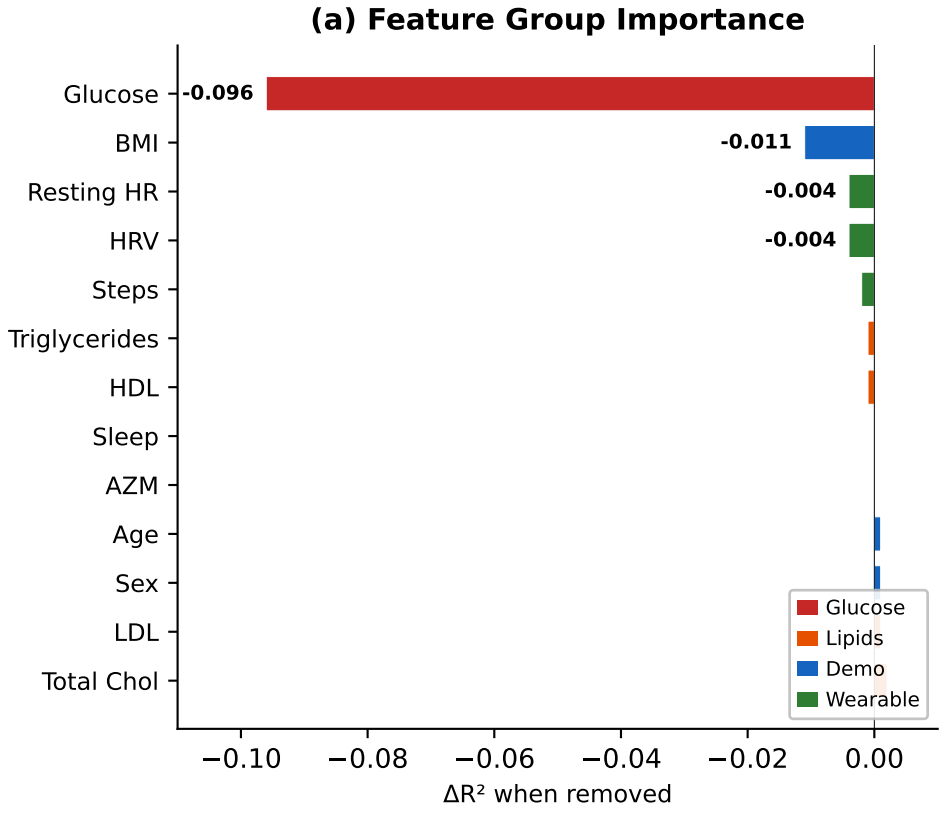
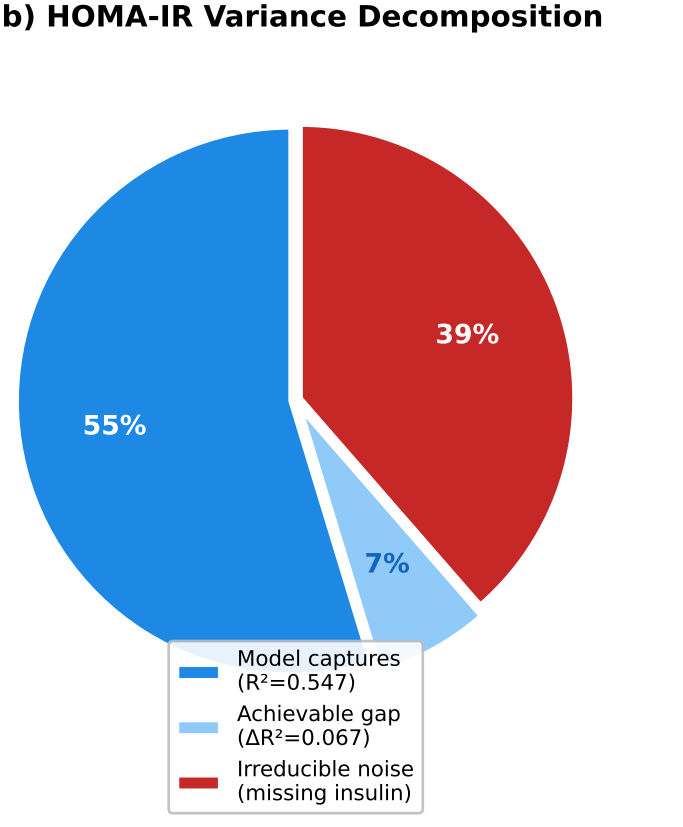
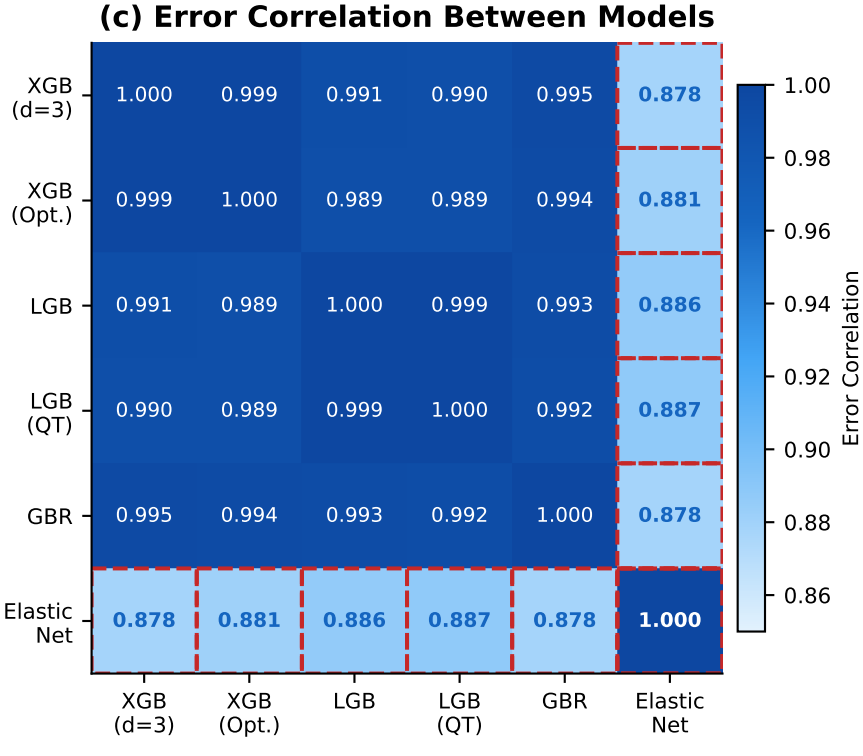
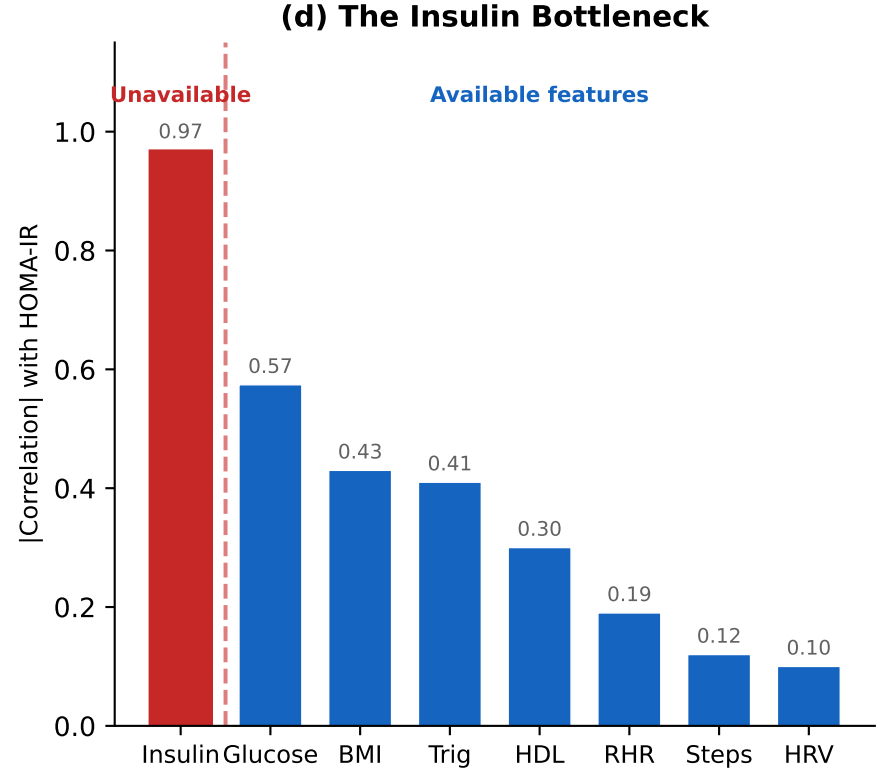

(a) Feature Group Importance
Glucose
BMI
Resting HR
HRV
Steps
Triglycerides
HDL
Sleep
AZM
Age
Sex
LDL
Total Chol
-0.096
-0.011
-0.004
-0.004
Glucose
Lipids
Demo
Wearable
−0.10
−0.08
−0.06
−0.04
−0.02
0.00
ΔR² when removed


(b) HOMA-IR Variance Decomposition
39%
55%
7%
Model captures (R²=0.547)
Achievable gap (ΔR²=0.067)
Irreducible noise (missing insulin)


(c) Error Correlation Between Models
XGB (d=3)
XGB (Opt.)
LGB
LGB (QT)
GBR
Elastic Net
1.000 0.999 0.991 0.990 0.995 0.878
0.999 1.000 0.989 0.989 0.994 0.881
0.991 0.989 1.000 0.999 0.993 0.886
0.990 0.989 0.999 1.000 0.992 0.887
0.995 0.994 0.993 0.992 1.000 0.878
0.878 0.881 0.886 0.887 0.878 1.000
Error Correlation
1.00
0.98
0.96
0.94
0.92
0.90
0.88
0.86


(d) The Insulin Bottleneck
Unavailable
Available features
|Correlation| with HOMA-IR
1.0
0.8
0.6
0.4
0.2
0.0
0.97
0.57
0.43
0.41
0.30
0.19
0.12
0.10
Insulin
Glucose
BMI
Trig
HDL
RHR
Steps
HRV