**Supplementary Table 1a: Single Feature Panel (AGM)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Features: Mid-upper arm circumference at mid-gestation (MUAC)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.66943522Fold 2: 0.56561462Fold 3: 0.76328904Fold 4: 0.80398671Fold 5: 0.76162791 | 0.71 (0.55, 0.88) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.66943522Fold 2: 0.56561462Fold 3: 0.76328904Fold 4: 0.80398671Fold 5: 0.76162791 | 0.71 (0.55, 0.88) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.001Initial learning rate = 0.1 | Fold 1: 0.67441860Fold 2: 0.56561462Fold 3: 0.75830565Fold 4: 0.80398671Fold 5: 0.76162791 | 0.71 (0.55, 0.88) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 5.0Learning rate = 0.0001Random Strength = 5.0 | Fold 1: 0.67607973Fold 2: 0.55730897Fold 3: 0.76910299Fold 4: 0.78737542Fold 5: 0.75913621 | **0.71 (0.54, 0.88)** |
| **Features: Diagnosis of gestational diabetes mellitus (WHO 1999) (GDM)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.63205980Fold 2: 0.72757475Fold 3: 0.56229236Fold 4: 0.53820598Fold 5: 0.71594684 | 0.64 (0.48, 0.79) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.63205980Fold 2: 0.72757475Fold 3: 0.56229236Fold 4: 0.53820598Fold 5: 0.71594684 | 0.64 (0.48, 0.79) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.1Initial learning rate = 0.001 | Fold 1: 0.63205980Fold 2: 0.72757475Fold 3: 0.56229236Fold 4: 0.53820598Fold 5: 0.71594684 | 0.64 (0.48, 0.79) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 1.0Learning rate = 0.00001Random Strength = 1.0 | Fold 1: 0.63205980Fold 2: 0.72757475Fold 3: 0.56229236Fold 4: 0.53820598Fold 5: 0.71594684 | **0.64 (0.48, 0.79)** |
| **Features: BMI at mid-gestation (BMI)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.70681063Fold 2: 0.56146179Fold 3: 0.74584718Fold 4: 0.82059801Fold 5: 0.75581395 | 0.72 (0.55, 0.89) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.70681063Fold 2: 0.56146179Fold 3: 0.74584718Fold 4: 0.82059801Fold 5: 0.75581395 | 0.72 (0.55, 0.89) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.1 | Fold 1: 0.70681063Fold 2: 0.56644518Fold 3: 0.74584718Fold 4: 0.82059801Fold 5: 0.75581395 | 0.72 (0.55, 0.89) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 5.0Learning rate = 0.05Random Strength = 4.0 | Fold 1: 0.73089701Fold 2: 0.66196013Fold 3: 0.82308970Fold 4: 0.83720930Fold 5: 0.74418605 | **0.76 (0.63, 0.89)** |
| **Features: Mean arterial blood pressure at mid-gestation (MAP)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.61794020Fold 2: 0.52408638Fold 3: 0.68023256Fold 4: 0.77906977Fold 5: 0.57973422 | 0.64 (0.46, 0.81) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.61794020Fold 2: 0.52408638Fold 3: 0.68023256Fold 4: 0.77906977Fold 5: 0.57973422 | 0.64 (0.46, 0.81) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.00001Initial learning rate = 0.01 | Fold 1: 0.61794020Fold 2: 0.53571429Fold 3: 0.68023256Fold 4: 0.77906977Fold 5: 0.57475083 | 0.64 (0.47, 0.81) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 6.0Learning rate = 0.00001Random Strength = 5.0 | Fold 1: 0.62790698Fold 2: 0.53073090Fold 3: 0.66528239Fold 4: 0.75083056Fold 5: 0.58056478 | **0.63 (0.48, 0.78)** |

**Supplementary Table 1b: Single Feature Panel (T2D)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Features: Mid-upper arm circumference at mid-gestation (MUAC)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.73456790Fold 2: 0.93209877Fold 3: 0.80246914Fold 4: 0.72839506Fold 5: 0.59876543 | 0.76 (0.55, 0.97) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.73456790Fold 2: 0.93209877Fold 3: 0.80246914Fold 4: 0.72839506Fold 5: 0.59876543 | 0.76 (0.55, 0.97) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.1 | Fold 1: 0.72222222Fold 2: 0.93209877Fold 3: 0.80246914Fold 4: 0.72839506Fold 5: 0.59876543 | 0.76 (0.55, 0.97) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 3.0Learning rate = 0.01Random Strength = 1.0 | Fold 1: 0.73456790Fold 2: 0.84876543Fold 3: 0.76543210Fold 4: 0.79629630Fold 5: 0.76543210 | **0.78 (0.71, 0.86)** |
| **Features: Diagnosis of gestational diabetes mellitus (WHO 1999) (GDM)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.92592593Fold 2: 0.68518519Fold 3: 0.69444444Fold 4: 0.59259259Fold 5: 0.75000000 | 0.73 (0.51, 0.95) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.92592593Fold 2: 0.68518519Fold 3: 0.69444444Fold 4: 0.59259259Fold 5: 0.75000000 | 0.73 (0.51, 0.95) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.001Initial learning rate = 0.1  | Fold 1: 0.92592593Fold 2: 0.68518519Fold 3: 0.69444444Fold 4: 0.59259259Fold 5: 0.75000000 | 0.73 (0.51, 0.95) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 1.0Learning rate = 0.00001Random Strength = 1.0 | Fold 1: 0.92592593Fold 2: 0.68518519Fold 3: 0.69444444Fold 4: 0.59259259Fold 5: 0.75000000 | **0.73 (0.51, 0.95)** |
| **Features: BMI at mid-gestation (BMI)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.75308642Fold 2: 0.89506173Fold 3: 0.87037037Fold 4: 0.68209877Fold 5: 0.54320988 | 0.75 (0.50, 0.99) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.75308642Fold 2: 0.89506173Fold 3: 0.87037037Fold 4: 0.68209877Fold 5: 0.54320988 | 0.75 (0.50, 0.99) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.001Initial learning rate = 0.1 | Fold 1: 0.75308642Fold 2: 0.89506173Fold 3: 0.87037037Fold 4: 0.68209877Fold 5: 0.54320988 | 0.75 (0.50, 0.99) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 5.0Learning rate = 0.00001Random Strength = 6.0 | Fold 1: 0.74074074Fold 2: 0.87037037Fold 3: 0.84876543Fold 4: 0.68518519Fold 5: 0.57716049 | **0.74 (0.53, 0.96)** |
| **Features: Mean arterial blood pressure at mid-gestation (MAP)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.54629630Fold 2: 0.61111111Fold 3: 0.69753086Fold 4: 0.66049383Fold 5: 0.77160494 | 0.66 (0.51, 0.81) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.54629630Fold 2: 0.61111111Fold 3: 0.69753086Fold 4: 0.66049383Fold 5: 0.77160494 | 0.66 (0.51, 0.81) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.1 | Fold 1: 0.54629630Fold 2: 0.61111111Fold 3: 0.30246914Fold 4: 0.66049383Fold 5: 0.77469136 | 0.66 (0.51, 0.81) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 6.0Learning rate = 0.00001Random Strength = 4.0 | Fold 1: 0.47222222Fold 2: 0.77777778Fold 3: 0.56172840Fold 4: 0.62037037Fold 5: 0.79629630 | **0.65 (0.40, 0.89)** |

**Supplementary Table 1c: Multiple Feature Panel (AGM)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Features: Mid-upper arm circumference at mid-gestation + Diagnosis of gestational diabetes mellitus (WHO 1999) (MUAC\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 5.0 | Fold 1: 0.74501661Fold 2: 0.72009967Fold 3: 0.68687708Fold 4: 0.73920266Fold 5: 0.82973422 | 0.74 (0.65, 0.84) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 3.0Loss function = ‘squared hinge’ | Fold 1: 0.74501661Fold 2: 0.72009967Fold 3: 0.68687708Fold 4: 0.73920266Fold 5: 0.82973422 | 0.74 (0.65, 0.84) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.1 | Fold 1: 0.74501661Fold 2: 0.72176080Fold 3: 0.69019934Fold 4: 0.73006645Fold 5: 0.82308970 | 0.74 (0.66, 0.83) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 3.0Learning rate = 0.001Random Strength = 4.0 | Fold 1: 0.74335548Fold 2: 0.73421927Fold 3: 0.68936877Fold 4: 0.73920266Fold 5: 0.82890365 | **0.75 (0.66, 0.84)** |
| **Features: BMI at mid-gestation + Diagnosis of gestational diabetes mellitus (WHO 1999) (BMI\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 2.0 | Fold 1: 0.77990033Fold 2: 0.74252492Fold 3: 0.68770764Fold 4: 0.75083056Fold 5: 0.81893688 | 0.76 (0.67, 0.84) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0 Loss function = ‘squared hinge’ | Fold 1: 0.77990033Fold 2: 0.73920266Fold 3: 0.68770764Fold 4: 0.75083056Fold 5: 0.82059801 | 0.76 (0.67, 0.84) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.01 | Fold 1: 0.78322259Fold 2: 0.72591362Fold 3: 0.69102990Fold 4: 0.75083056Fold 5: 0.82059801 | 0.76 (0.67, 0.84) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 5.0Learning rate = 0.3Random Strength = 6.0 | Fold 1: 0.78571429Fold 2: 0.80232558Fold 3: 0.77159468Fold 4: 0.80647841Fold 5: 0.74335548 | **0.78 (0.74, 0.83)** |
| **Features: Mean arterial blood pressure at mid-gestation + Diagnosis of gestational diabetes mellitus (WHO 1999) (MAP\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 9.0 | Fold 1: 0.72840532Fold 2: 0.73338870Fold 3: 0.63039867Fold 4: 0.71345515Fold 5: 0.75249169 | 0.71 (0.63, 0.80) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 6.0Loss function = ‘squared hinge’ | Fold 1: 0.72840532Fold 2: 0.73338870Fold 3: 0.63039867Fold 4: 0.71345515Fold 5: 0.75083056 | 0.71 (0.63, 0.79) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.0001Initial learning rate = 0.1 | Fold 1: 0.72840532Fold 2: 0.73338870Fold 3: 0.58139535Fold 4: 0.71345515Fold 5: 0.74252492 | 0.71 (0.63, 0.79) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 2.0Learning rate = 0.001Random Strength = 5.0 | Fold 1: 0.73172757Fold 2: 0.73671096Fold 3: 0.63704319Fold 4: 0.71677741Fold 5: 0.73671096 | **0.71 (0.64, 0.79)** |
| **Features: Mid-upper arm circumference at mid-gestation + BMI at mid-gestation + Mean arterial blood pressure at mid-gestation Diagnosis of gestational diabetes mellitus (WHO 1999) (MUAC\_BMI\_MAP\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.76411960Fold 2: 0.72923588Fold 3: 0.69601329Fold 4: 0.76411960Fold 5: 0.82558140 | 0.76 (0.67, 0.84) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘squared hinge’ | Fold 1: 0.76411960Fold 2: 0.72093023Fold 3: 0.70265781Fold 4: 0.75581395Fold 5: 0.82392027 | 0.75 (0.67, 0.84) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.1 | Fold 1: 0.77408638Fold 2: 0.72591362Fold 3: 0.70265781Fold 4: 0.74584718Fold 5: 0.82225914 | 0.76 (0.67, 0.84) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 3.0Learning rate = 0.001Random Strength = 6.0 | Fold 1: 0.75415282Fold 2: 0.75249169Fold 3: 0.72093023Fold 4: 0.76744186Fold 5: 0.79900332 | **0.76 (0.71, 0.81)** |

**Supplementary Table 1d: Multiple Feature Panel (T2D)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Features: Mid-upper arm circumference at mid-gestation + Diagnosis of gestational diabetes mellitus (WHO 1999) (MUAC\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.93209877Fold 2: 0.87037037Fold 3: 0.82407407Fold 4: 0.78395062Fold 5: 0.84567901 | 0.85 (0.75, 0.95) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 5.0Loss function = ‘squared hinge’ | Fold 1: 0.93209877Fold 2: 0.87037037Fold 3: 0.84876543Fold 4: 0.78395062Fold 5: 0.83950617 | 0.86 (0.76, 0.95) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.1 | Fold 1: 0.93209877Fold 2: 0.86419753Fold 3: 0.81481481Fold 4: 0.78395062Fold 5: 0.83950617 | 0.86 (0.76, 0.96) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 3.0Learning rate = 0.01Random Strength = 3.0 | Fold 1: 0.91975309Fold 2: 0.85802469Fold 3: 0.85493827Fold 4: 0.80864198Fold 5: 0.93209877 | **0.88 (0.79, 0.96)** |
| **Features: BMI at mid-gestation + Diagnosis of gestational diabetes mellitus (WHO 1999) (BMI\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.95061728Fold 2: 0.85802469Fold 3: 0.86419753Fold 4: 0.74382716Fold 5: 0.84567901 | 0.85 (0.72, 0.98) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘squared hinge’ | Fold 1: 0.95061728Fold 2: 0.85802469Fold 3: 0.86419753Fold 4: 0.74382716Fold 5: 0.83950617 | 0.85 (0.72, 0.98) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.1 | Fold 1: 0.94135802Fold 2: 0.85185185Fold 3: 0.86419753Fold 4: 0.74382716Fold 5: 0.82716049 | 0.85 (0.73, 0.97) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 5.0Learning rate = 0.0001Random Strength = 5.0 | Fold 1: 0.95679012Fold 2: 0.86419753Fold 3: 0.86419753Fold 4: 0.74382716Fold 5: 0.85185185 | **0.86 (0.72, 0.99)** |
| **Features: Mean arterial blood pressure at mid-gestation + Diagnosis of gestational diabetes mellitus (WHO 1999) (MAP\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.91975309Fold 2: 0.77777778Fold 3: 0.76543210Fold 4: 0.80246914Fold 5: 0.88271605 | 0.83 (0.71, 0.95) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘squared hinge’ | Fold 1: 0.91975309Fold 2: 0.77777778Fold 3: 0.76543210Fold 4: 0.80246914Fold 5: 0.88271605 | 0.83 (0.71, 0.95) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.001Initial learning rate = 0.1 | Fold 1: 0.92592593Fold 2: 0.76543210Fold 3: 0.76543210Fold 4: 0.37037037Fold 5: 0.87037037 | 0.82 (0.68, 0.96) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 6.0Learning rate = 0.00001Random Strength = 2.0 | Fold 1: 0.91975309Fold 2: 0.79629630Fold 3: 0.77777778Fold 4: 0.80555556Fold 5: 0.90123457 | **0.84 (0.73, 0.96)** |
| **Features: Mid-upper arm circumference at mid-gestation + BMI at mid-gestation + Mean arterial blood pressure at mid-gestation Diagnosis of gestational diabetes mellitus (WHO 1999) (MUAC\_BMI\_MAP\_GDM)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 2.0 | Fold 1: 0.93827160Fold 2: 0.83950617Fold 3: 0.85185185Fold 4: 0.77777778Fold 5: 0.87037037 | 0.86 (0.76, 0.96) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘squared hinge’ | Fold 1: 0.93209877Fold 2: 0.83333333Fold 3: 0.85185185Fold 4: 0.77777778Fold 5: 0.86419753 | 0.85 (0.75, 0.95) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.001Initial learning rate = 0.1 | Fold 1: 0.90740741Fold 2: 0.78395062Fold 3: 0.85185185Fold 4: 0.76543210Fold 5: 0.85802469 | 0.84 (0.73, 0.95) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 4.0Learning rate = 0.00001Random Strength = 1.0 | Fold 1: 0.93209877Fold 2: 0.86419753Fold 3: 0.83950617Fold 4: 0.78395062Fold 5: 0.87037037 | **0.86 (0.76, 0.95)** |

**Supplementary Table 1e: Sensitivity Analysis (AGM)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Features: BMI at mid-gestation + Diagnosis of gestational diabetes mellitus (modified two-point IADPSG 2018) (BMI\_GDM2)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.77159468Fold 2: 0.73920266Fold 3: 0.76578073Fold 4: 0.76079734Fold 5: 0.80564784 | 0.77 (0.73, 0.81) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.77159468Fold 2: 0.73920266Fold 3: 0.76578073Fold 4: 0.76079734Fold 5: 0.80564784 | 0.77 (0.73, 0.81) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.1Initial learning rate = 0.01 | Fold 1: 0.77325581Fold 2: 0.73920266Fold 3: 0.76578073Fold 4: 0.76079734Fold 5: 0.81063123 | 0.77 (0.72, 0.82) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 2.0Learning rate = 0.03Random Strength = 5.0 | Fold 1: 0.76910299Fold 2: 0.79651163Fold 3: 0.86129568Fold 4: 0.75996678Fold 5: 0.76993355 | **0.79 (0.72, 0.86)** |
| **Features: BMI at mid-gestation + Fasting Glucose (BMI\_Fasting)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.67774086Fold 2: 0.61627907Fold 3: 0.80564784Fold 4: 0.84219269Fold 5: 0.82059801 | 0.75 (0.58, 0.93) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘squared hinge’ | Fold 1: 0.64451827Fold 2: 0.62624585Fold 3: 0.78737542Fold 4: 0.83222591Fold 5: 0.81727575 | 0.74 (0.57, 0.92) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.00001Initial learning rate = 0.01 | Fold 1: 0.64950166Fold 2: 0.57641196Fold 3: 0.80066445Fold 4: 0.83720930Fold 5: 0.82724252 | 0.75 (0.57, 0.93) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 3.0Learning rate = 0.01Random Strength = 1.0 | Fold 1: 0.68853821Fold 2: 0.65780731Fold 3: 0.89617940Fold 4: 0.90863787Fold 5: 0.80564784 | **0.79 (0.59, 0.99)** |
| **Features: BMI at mid-gestation + Fasting Glucose (BMI\_2hour)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 8.0 | Fold 1: 0.77740864Fold 2: 0.73588040Fold 3: 0.72093023Fold 4: 0.74086379Fold 5: 0.83554817 | 0.76 (0.68, 0.84) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 6.0Loss function = ‘squared hinge’ | Fold 1: 0.77740864Fold 2: 0.73588040Fold 3: 0.72093023Fold 4: 0.74086379Fold 5: 0.83554817 | 0.76 (0.68, 0.84) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.001Initial learning rate = 0.1 | Fold 1: 0.77740864Fold 2: 0.73255814Fold 3: 0.71428571Fold 4: 0.73754153Fold 5: 0.83056478 | 0.76 (0.68, 0.85) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 6.0Learning rate = 0.001Random Strength = 1.0 | Fold 1: 0.78737542Fold 2: 0.73588040Fold 3: 0.69767442Fold 4: 0.75415282Fold 5: 0.81561462 | **0.76 (0.68, 0.84)** |
| **Features: BMI at mid-gestation + Fasting Glucose + 2-hour Glucose (BMI\_Fasting\_2hour)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 2.0 | Fold 1: 0.75415282Fold 2: 0.75415282Fold 3: 0.72923588Fold 4: 0.74418605Fold 5: 0.86544850 | 0.77 (0.67, 0.87) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 3.0Loss function = ‘squared hinge’ | Fold 1: 0.73421927Fold 2: 0.74916944Fold 3: 0.73255814Fold 4: 0.75249169Fold 5: 0.86378738 | 0.77 (0.67, 0.86) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.01Initial learning rate = 0.01 | Fold 1: 0.76578073Fold 2: 0.74584718Fold 3: 0.71594684Fold 4: 0.74916944Fold 5: 0.84883721 | 0.77 (0.68, 0.85) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 4.0Learning rate = 0.001Random Strength = 5.0 | Fold 1: 0.76079734Fold 2: 0.75249169Fold 3: 0.75415282Fold 4: 0.76744186Fold 5: 0.85714286 | **0.78 (0.70, 0.86)** |
| **Features: Pre-pregnancy BMI (ppBMI)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |  |  |  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.84807692Fold 2: 0.72115385Fold 3: 0.65096154Fold 4: 0.71346154Fold 5: 0.60096154 | 0.71 (0.54, 0.87) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.84807692Fold 2: 0.72115385Fold 3: 0.65096154Fold 4: 0.71346154Fold 5: 0.60096154 | 0.71 (0.54, 0.87) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.0001Initial learning rate = 0.1 | Fold 1: 0.85288462Fold 2: 0.72115385Fold 3: 0.65096154Fold 4: 0.71346154Fold 5: 0.60096154 | 0.71 (0.54, 0.87) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 1.0Learning rate = 0.05Random Strength = 6.0 | Fold 1: 0.84423077Fold 2: 0.75961538Fold 3: 0.69711538Fold 4: 0.67307692Fold 5: 0.62788462 | **0.72 (0.57, 0.87)** |

**Supplementary Table 1f: Sensitivity Analysis (T2D)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Features: BMI at mid-gestation + Diagnosis of gestational diabetes mellitus (modified two-point IADPSG 2018) (BMI\_GDM2)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications**  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.83950617Fold 2: 0.88888889Fold 3: 0.83333333Fold 4: 0.76851852Fold 5: 0.95679012 | 0.86 (0.73, 0.98) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘squared hinge’ | Fold 1: 0.83950617Fold 2: 0.88888889Fold 3: 0.83333333Fold 4: 0.76851852Fold 5: 0.95679012 | 0.86 (0.73, 0.98) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.1Initial learning rate = 0.1 | Fold 1: 0.83950617Fold 2: 0.89506173Fold 3: 0.83333333Fold 4: 0.76851852Fold 5: 0.95061728 | 0.86 (0.74, 0.98) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 3.0Learning rate = 0.00001Random Strength = 1.0 | Fold 1: 0.83950617Fold 2: 0.84567901Fold 3: 0.80864198Fold 4: 0.76851852Fold 5: 0.95679012 | **0.84 (0.72, 0.97)** |
| **Features: BMI at mid-gestation + Fasting Glucose (BMI\_Fasting)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.74691358Fold 2: 0.91358025Fold 3: 0.79629630Fold 4: 0.69753086Fold 5: 0.62962963 | 0.76 (0.57, 0.95) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘squared hinge’ | Fold 1: 0.73456790Fold 2: 0.86419753Fold 3: 0.59259259Fold 4: 0.67283951Fold 5: 0.67901235 | 0.71 (0.53, 0.89) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.00001Initial learning rate = 0.1 | Fold 1: 0.75925926Fold 2: 0.88888889Fold 3: 0.72222222Fold 4: 0.69753086Fold 5: 0.64814815 | 0.74 (0.58, 0.90) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 4.0Learning rate = 0.001Random Strength = 1.0 | Fold 1: 0.75308642Fold 2: 0.88888889Fold 3: 0.79938272Fold 4: 0.66666667Fold 5: 0.70987654 | **0.76 (0.61, 0.91)** |
| **Features: BMI at mid-gestation + 2-hour Glucose (BMI\_2hour)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 10.0 | Fold 1: 0.93209877Fold 2: 0.91358025Fold 3: 0.80246914Fold 4: 0.81481481Fold 5: 0.88271605 | 0.87 (0.77, 0.97) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 3.0Loss function = ‘hinge’ | Fold 1: 0.90123457Fold 2: 0.92592593Fold 3: 0.82098765Fold 4: 0.82098765Fold 5: 0.85802469 | 0.87 (0.78, 0.95) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.001Initial learning rate = 0.01 | Fold 1: 0.93209877Fold 2: 0.90740741Fold 3: 0.80246914Fold 4: 0.81481481Fold 5: 0.88271605 | 0.87 (0.77, 0.97) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 6.0Learning rate = 0.0001Random Strength = 6.0 | Fold 1: 0.91358025Fold 2: 0.89814815Fold 3: 0.82098765Fold 4: 0.77777778Fold 5: 0.87654321 | **0.86 (0.76, 0.96)** |
| **Features: BMI at mid-gestation + Fasting Glucose + 2-hour Glucose (BMI\_Fasting\_2hour)** | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 3.0 | Fold 1: 0.93209877Fold 2: 0.88888889Fold 3: 0.70987654Fold 4: 0.79629630Fold 5: 0.85802469 | 0.84 (0.69, 0.99) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 2.0Loss function = ‘squared hinge’ | Fold 1: 0.93209877Fold 2: 0.87037037Fold 3: 0.66049383Fold 4: 0.77777778Fold 5: 0.82098765 | 0.81 (0.63, 0.99) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.00001Initial learning rate = 0.01 | Fold 1: 0.92592593Fold 2: 0.82098765Fold 3: 0.58024691Fold 4: 0.80864198Fold 5: 0.81481481 | 0.84 (0.69, 0.99) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 5.0Learning rate = 0.0001Random Strength = 5.0 | Fold 1: 0.90123457Fold 2: 0.87037037Fold 3: 0.80864198Fold 4: 0.75925926Fold 5: 0.85185185 | **0.84 (0.74, 0.94)** |
| **Features: Pre-pregnancy BMI (ppBMI)**  | **Hyperparameters tuned using grid search** | **5-fold stratified cross validation scores of best estimator (AUC)** | **Average AUC (95% CI)** |
| **Model Specifications** |  |  |  |
| Logistic Regression (L2 regularization penalty, stochastic average gradient descent solver) | Inverse of regularization strength = 1.0 | Fold 1: 0.53333333Fold 2: 0.65333333Fold 3: 0.73333333Fold 4: 0.48000000Fold 5: 0.74000000 | 0.63 (0.42, 0.83) |
| Support Vector Machine (linear kernel, L2 regularization penalty) | L2 regularization penalty = 1.0Loss function = ‘hinge’ | Fold 1: 0.53333333Fold 2: 0.65333333Fold 3: 0.73333333Fold 4: 0.48000000Fold 5: 0.74000000 | 0.63 (0.42, 0.83) |
| Neural Network (3 hidden layers with 10 neurons each, ReLU activation function, Adam solver, 200 iterations)  | L2 regularization penalty = 0.00001Initial learning rate = 0.1 | Fold 1: 0.53333333Fold 2: 0.62333333Fold 3: 0.73333333Fold 4: 0.48000000Fold 5: 0.74000000 | 0.63 (0.42, 0.83) |
| **CatBoost** (1000 iterations, maximum depth of 6 trees, symmetric tree growing policy) | L2 leaf regularization = 1.0Learning rate = 0.00001Random Strength = 3.0 | Fold 1: 0.55333333Fold 2: 0.62666667Fold 3: 0.75333333Fold 4: 0.43333333Fold 5: 0.75000000 | **0.62 (0.39, 0.86)** |