Supplementary Material

A systematic review of Machine Learning and Deep Learning approaches in Mexico: challenges and opportunities

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# Supplementary Tables

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| **Research** | **Location** | **Applied models** | **Performance metrics** |
| Remote Sensing | | | |
| Arellano-Verdejo and Lazcano-Hernández (2021) | Campeche, Yucatán, Quintana Roo | CNN | Accuracy, Recall, Precision, F1-score |
| Arellano-Verdejo et al. (2019) | Quintana Roo | CNN, MLP | Accuracy |
| Arias-Rodriguez et al. (2020) | CDMX | Linear Regression, RF, SVR, GPR | RMSE, R2 |
| Carmona et al. (2021) | Nuevo León | MLR, ANN | *r*, RMSE, MAE |
| López-Serrano et al. (2020) | National | RF, SVR | RMSE, R2 |
| Mejia-Zuluaga et al. (2022) | CDMX | SVC | Accuracy, Recall, Precision, Kappa |
| Pech-May et al. (2022) | Tabasco | SVM, RF, CART | Accuracy, Kappa |
| Salvador et al. (2020) | National | SVM, RF, GLM | %RMSE, R2 |
| Schulthess et al. (2023) | Sonora | RF | Accuracy, Recall, Precision, F1-score |
| Meteorology Atmospherics Sciences | | | |
| Ahmad et al. (2022) | CDMX | RF, GTB, ANN, MLR | R2, Index of Agreement (IOA) |
| Becerra-Rico et al. (2020) | CDMX | GRU, LSTM | RMSE |
| Contreras-Navarro et al. (2016) | Baja California | ANN, PLSR, GLR, Ridge Regression, CART | nRMSE, R2, VAR |
| Coria et al. (2016) | National | C4.5 | Accuracy, F1-score, Kappa |
| Espinosa-Guzmán et al. (2017) | Campeche | ANN | R2, MSE, MAE |
| Gutiérrez-Avila et al. (2022) | CDMX | XGBoost | RMSE, MAE, MAD, R2, SD |
| Quej et al. (2022) | Campeche, Yucatán, Quintana Roo | SVM, ANFIS, CatBoost | R2, NSE, RMSE, MAE, MBE |
| Magallanes-Quintanar et al. (2023) | Zacatecas | ANN | R2, MSE, MAE |
| Ramos-Cirilo et al. (2021) | Campeche | SVM, XGBoost, GEP | R2, MAE, RMSE, MBE |
| Zhu and Aguilera (2021) | National | RF | RMSE, MAE, R2 |
| Medicine | | | |
| Almustafa (2021) | National | Naive Bayes, RF, KNN, SGD, Decision Tree | RMSE, MAE, Accuracy, AUC |
| Appice et al. (2020) | National | M5, SVR, KNN | RMSE |
| Argueta-Santillan et al. (2021) | National | CNN, SVM, RF, Logistic Regression, Naïve Bayes | Accuracy, Recall, Precision, F1-score |
| Baak-Baak et al. (2022) | National | Clustering | Kruskal-Wallis |
| Becerra-Sánchez et al. (2022) | National | KNN, Logistic Regression, RF, ANN | Accuracy, Recall, Precision, F1-score |
| Carrillo-Vega et al. (2022) | National | Self-organizing map (SOM) | Kruskal Wallis, ANOVA |
| Castillo-Olea et al. (2019) | Baja California | KNN, SVM, RBF, Gaussian Process, RF, MLP, AdaBoost, Naïve Bayes, QDA | Accuracy, Precision, F1-score |
| Castillo-Olea et al. (2020) | Baja California | SVM, Decision Tree, RBF, Gaussian Process, RF, MLP, AdaBoost, Naïve Bayes, QDA | Accuracy, Precision, F1-score |
| Castillo-Olea et al. (2021) | Baja California | Decision Tree, SVM, RF, Logistic Regression, MLP, Naïve Bayes, AdaBoost | AUC, Accuracy, F1-score, Precision, Recall |
| Chadaga et al. (2021) | National | RF, AdaBoost, XGBoost, Catboost | Accuracy, Precision, Recall, F1-score, AUC |
| Gallardo-Rincón et al. (2023) | National | ANN | Recall, Specificity, precision, AUC |
| Gasperín-Rodríguez et al. (2022) | Veracruz | Clustering | *p*-value |
| Gónzalez-Bandala et al. (2020) | National | MLP | *r*, RMSE, RMSPE, MAPE |
| Gonzalez-Briceno et al. (2020) | Jalisco | CNN | Accuracy, Loss, Recall, Specificity, AUC |
| Gutiérrez-Esparza et al. (2020) | CDMX | RF | Accuracy, Recall, Specificity |
| Gutiérrez-Esparza et al. (2021) | CDMX | RF, C4.5, ANN | PPV, NPV, Accuracy, Balanced Accuracy |
| Guzmán-Torres et al. (2021) | National | Logistic Regression | Accuracy, Precision, Recall, F1-score, AUC |
| Martínez-Velasco et al. (2019) | National | RF | AUC, Accuracy, Average Accuracy, Precision, Recall, Specificity, F1-score |
| Morgan-Benita et al. (2022) | National | GLM, SVM, ANN | AUC, Recall, Specificity, Precision, Accuracy, F1-score, FPR, FNR, NPV |
| Muhammad et al. (2021) | National | Logistic Regression, Decision Tree, SVM, Naïve Bayes, ANN | Accuracy, Recall, Specificity |
| Pradhan et al. (2022) | National | Logistic Regresion, RF, XGBoost, AdaBoost, KNN, ANN | Accuracy, Precision, Recall, F1-score, AUC, Confusion Matrix |
| Prieto (2022) | National | Logistic Regresion, Decision Tree, KNN, Naïve Bayes, XGBoost, RF | Confusion Matrix |
| Quiroz-Juárez et al. (2021) | National | ANN, Logistic Regression, SVM, KNN | Accuracy, Recall, Sensitivity |
| Rojas-García et al. (2023) | National | SVM, XGBoost, RF, Logistic Regression | F1-score, Accuracy, Recall, Specificity, PPV, NPV |
| Rojas-Mendizabal et al. (2021) | Baja California | SVM, KNN, RF, Logistic Regression, Classification Tree | Accuracy, F1-score, Precision, Recall |
| Soto-Murillo et al. (2021) | National | KNN, Naïve Bayes, Decision Tree, Logistic Regression, SVM, ANN | Accuracy, Recall, Specificity, Precision, F1-score, AUC |
| Urrutia and Villalobos (2022) | National | C5.0 | AUC, Accuracy, Recall and Specificity |
| Vázquez et al. (2020) | National | KNN, ANN, RF | AUC |
| Geosciences | | | |
| Titos et al. (2020) | Colima | CNN, MLP, RF, SVM | Accuracy |
| Trejo-Alonso et al. (2021) | Querétaro | ANN | RMSE, R2, MAE |
| Bustillos et al. (2021) | CDMX | ANN | Accuracy, Precision, Recall, F1-score, among others |
| Social Sciences | | | |
| Ávila-Solís et al. (2022) | National | Logistic Regression, SVM, RF | Accuracy, F1-score, Precision, Recall, F-macro, AUC, P-S curve |
| Barreda-Luna et al. (2022) | Queretaro | ANN | RMSE, R2, MBE |
| Bello-Valle et al. (2022) | National | C4.5, CART, Naïve Bayes, SVC, KNN, AdaBoost, RF | Accuracy, F1-score |
| Castorena et al. (2021) | National | MLP | AUC, Recall, Specificity |
| Contreras-Hernández et al. (2023) | National | BERT, SVM, Naïve Bayes, Logistic Regression, Decision Tree | Precision, F1-score, Recall |
| Corona (2022) | National | RF | Accuracy, Precision, Recall, F1-score, R2 |
| González-Rossano et al. (2023) | National | Linear Regression, RF, PCA | MAE |
| Gutiérrez et al. (2018) | Aguascalientes | RF, SVM | Accuracy, Recall, Specificity, AUC |
| Gutiérrez-Esparza et al. (2019) | National | RF | Accuracy, Recall, Specificity, Kappa |
| Orozco-Ramírez et al. (2022) | Oaxaca | RF | Error Rate |
| Rodriguez‐Barrios et al. (2021) | National | Bayesian Network | Precision |
| Salas-Rueda and Castañeda-Martínez (2021) | CDMX | Linear Regression | MSE |
| Salas-Rueda and Ramírez-Ortega (2021) | CDMX | Linear Regression | MSE |
| Salas-Rueda (2020) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2020a) | CDMX | Linear Regression, Decision, Tree | MSE |
| Salas-Rueda et al. (2020b) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2021a) | CDMX | Linear Regression | MSE |
| Salas-Rueda et al. (2021e) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2021b) | CDMX | Linear Regression | MSE |
| Salas-Rueda et al. (2021d) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2022c) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2021c) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2022a) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2022b) | CDMX | Linear Regression, Decision Tree | MSE |
| Salas-Rueda et al. (2022d) | CDMX | Linear Regression, Decision Tree | MSE |
| Saldana-Perez et al. (2019) | CDMX | SVM | Accuracy |
| Terán-Bustamante et al. (2021) | CDMX | SVM, Naïve Bayes, ANN | AUC, F1-score, Precision, Recall |
| Urbina-Nájera and Hernández-Calva (2022) | CDMX | Clustering | N/A |
| Rincón (2023) | National | Logistic Regression, RF, SVM | Accuracy, Recall, Specificity, Precision, NPV, F1-score, Kappa |
| Agricultural and biological sciences | | | |
| Barreras et al. (2023) | National | RF, SVM, ANN, GLM | R2, RMSE |
| Campos-Ferreira and González-Camacho (2021) | Morelos | CNN | Accuracy, Recall, Precision, F1\_s |
| Gómez et al. (2021b) | National | SVM, RF, GLM | R2, %RMSE |
| Gómez et al. (2021a) | National | GLM, Ridge regression, Partial Least Square Regression, KNN, SVM, XGBoost, RF | R2, RMSE |
| Gomez-Flores et al. (2022) | National | CNN, MLP | Accuracy, Recall, Specificity, Mattews Correlation Coefficient (MCC) |
| Hernández-Moreno et al. (2021) | Puebla | RF | Accuracy, Kappa |
| Huang et al. (2022) | National | PCA, Partial Least Square Regression | N/A |
| Olguín-Rojas et al. (2022) | National | CNN | Accuracy, Recall, F1-score, Precision |
| Romero-Sanchez et al. (2022) | CDMX, Oaxaca, Michoacán | RF, GLM | Accuracy, AUC, Recall, Specificity |
| Servín-Palestina et al. (2022) | Zacatecas | MLP | R2, MAE, RMSE, MSE, NSE |
| Zamora-Gutierrez et al. (2016) | National | RF | Accuracy |
| Environmental Sciences | | | |
| Avila-Perez et al. (2023) | Guerrero | Logistic Regression, SVM | Accuracy, Precision, Recall |
| Cruz-López et al. (2019) | National | RF | RMSE |
| Fernández del Castillo et al. (2022) | Jalisco | Linear Regression, MLR, Logistic Regression | RSE, MSE, R2 |
| Gao et al. (2023) | Jalisco | ANN, RF, Logistic Regression | Accuracy |
| Hartman et al. (2022) | Michoacán | SVM | Accuracy |
| Illoldi-Rangel et al. (2008) | Oaxaca | GA | N/A |
| Kampichler et al. (2010) | Yucatán | RF, Classification Trees | Accuracy |
| Knappett et al. (2020) | Guanajuato | PCA, RF | R2, RMSE |
| Maciel-Nájera et al. (2021) | Chihuahua | RF | AUC, Recall, Specificity |
| Powlen et al. (2023) | National | RF | R2, MAE |
| Prieto-Amparán et al. (2019) | Chihuahua | SVM | Fuzzy Similarity Index |
| Quintero et al. (2014) | National | RF | Precision, F1-score, Recall |
| Ramos-Bernal et al. (2021) | Guerrero | KNN, SVM, AdaBoost | Accuracy, Precision, Recall, F1-score, Kappa |
| Tello-Mijares and Flores (2016) | Coahuila, Durango | RF, MLP, Bayesian Network | Sensitivity, Precision, FPR, Harmonic Mean |
| Torres-Vera (2023) | Guadalajara | MLR | R2, RMSE |
| Economics, Econometrics and Finance | | | |
| Cuaya-Simbro et al. (2022) | CDMX | CNN | Accuracy, Confusion Matrix |
| Dobler-Morales et al. (2022) | Oaxaca | RF, Cluster | Error rate, Confusion Matrix |
| Rocha-Salazar et al. (2021) | National | ANN | Accuracy, Error rate |
| Energy | | | |
| Cruz-May et al. (2021) | Yucatán | ANFIS, ANN, GMDH | RMSE, R2 |
| Ibargüengoytia-González et al. (2021) | Oaxaca | Bayesian Network | Error rate |
| Ramirez-Gonzalez et al. (2022) | Baja California Sur | CNN, SVM, KNN | Accuracy |
|  |  |  |  |
| Villegas-Mier et al. (2022) | Queretaro | RF, Adaboost, LR, RNN, SVM | Accuracy, MSE, RMSE, MAE, MAPE, R2 |
| Arts and Humanities | | | |
| López-García et al. (2020) | Tlaxcala | PCA, Cluster | -- |
| Ramírez-Eudave et al. (2023) | Morelos | RF | Accuracy |
| Neurosciences | | | |
| Delgado-Gallegos et al. (2023) | National | C5.0 | Accuracy |
| Gomez-Cravioto et al. (2021) | National | RNN | RMSE |
| Mathematics | | | |
| Pérez-Ortega et al. (2022) | National | Cluster | -- |
| Biochemistry | | | |
| Sánchez-Delacruz et al. (2019) | Tabasco | MLP, AdaBoost | Accuracy |
| Business, Management and Accounting | | | |
| López-Chau et al. (2022) | Hidalgo | ANN | RMSE, MAE, R2 |
| Political Sciences | | | |
| Cantú (2019) | National | CNN | Accuracy |

Table S1. Extracted information of the 120 reviewed articles. Graphical information can be found across Section 3.

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