**Rapport Avancement**

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Introduction

Dans ce bref rapport d’avancement, il est question de comparer l’aptitude de plusieurs modèles de risques, dont le modèle empirique avec différentes combinaison entre Qi (indicateurs de qualité intrinsèques) et métrique Orienté Objets, à prédire dans un premier temps l’existence de faute puis le niveau de sévérité des fautes si permis au cours de cette étude.

Présentation des Données

Dans le format d’un fichier Excel, nous disposons de données sur le système ANT ou chaque classe est décrite avec le nombre de bugs qu’elle contient, leur sévérité qui peut être soit : bloquante, critique, majeur, normal, mineur ou bien trivial. En suite dans ce qui nous intéresse le différente combinaison entre Qi (indicateurs de qualité intrinsèques) et combinaison d’autres métriques OO : d(LOC, FANIN), d(LOC, FANIN), d(WMC, FANIN) , d(WMC, CBO), d(Qi, CBO), d(LOC, CBO), d(LOC, Ce), d(LOC, Ca), d(WMC, Ce) et enfin d(WMC, Ca).

Le tableau suivant décrit les différents systèmes Ant utilisés et met en évidence le nombre de classes, nombre de classes fautives ainsi que le ratio des classes fautives.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Système*** | ***#Classes*** | ***#Fautives*** | ***%Fautives*** | ***#ClassesD*** | ***#FautivesD*** | ***%FautivesD*** |
| Ant13 | 126 | 60 | 47.62% | 201 | 135 | 67.16% |
| Ant14 | 178 | 38 | 21.35% | 190 | 50 | 26.21% |
| Ant15 | 293 | 106 | 36.62% | 366 | 179 | 48.91% |
| Ant16 | 352 | 45 | 12.78% | 368 | 61 | 16.58% |
| Ant17 | 675 | 70 | 10.37% | 776 | 101 | 13.01% |

On constate que le ratio du nombre des classes fautives est très faible pour les deux derniers systèmes. Ce qui rend le problème de prédiction des classes fautives d’autant plus difficiles pour ces deux cas en particulier.

Hypothèse

H0 : Un des modèles citées précédemment peut permettre de prédire l’existence de fautes dans

une classe logicielle.

H1 : Une imbrication de modèles citées précédemment peut permettre de prédire l’existence

de fautes dans une classe logicielle.

H2 : Un des modèles citées précédemment peut permettre de prédire l’existence de fautes de

sévérité : élevé, normal ou faible dans une classe logicielle.

H3 : Une imbrication de modèles citées précédemment peut permettre de prédire l’existence

de fautes sévérité : élevé, normal ou faible dans une classe logicielle.

Pré-Processing

En termes de prétraitements des données les opérations suivantes ont été effectuées sur l’ensemble des données sur les différents systèmes ANT :

* Binarisation du nombre de fautes d’une classe  dans un nouvel attribut appelé *‘BugsBinary’*: i.e. 0 veut dire absence de faute et 1 veut dire présence d’une ou plusieurs fautes. En effet, on remarque que le nombre de classes qui comportent plus d’une faute n’est pas très significatif par conséquent on a préféré ignorer la prédiction du nombre exacte du nombre de faute d’une classe qui demeure encore hors de portée.
* Regroupement des fautes de sévérités Blocker, critical et major pour former les fautes de sévérité élevée. Normal seul pour former les fautes de sévérité normale. Minor et trivial pour former les fautes de sévérité faible.
* Par soucis de compatibilité lors de l’utilisation de certains algorithmes de Machines Learning, le filtre de transformation en type nominal a été appliqué sur l’attribut classe à prédire *‘BugsBinary’*.
* Dans le but d’améliorer les résultats de la prédiction une normalisation a été effectuée sur les modèles pour aboutir à des valeurs comprises dans l’intervalle [-1, 1].
* Nous explorons également l’apport de technique de stratification tel l’oversampling en appliquant le filtre Smote et la duplication des classes fautives.

Comparaison entre Différentes Approches

1. Existence de Faute :

Les tableaux suivants décrivent les résultats du taux de classification des algorithmes utilisés accompagné de leur accuracy et g-means respectifs. Naïve Bayes, la régression logistique, SVM, ANN (Multi-layer Perception), J48 et Random Forest pour les arbres de décisions en s’aidant de différentes combinaisons des modèles avec une 10 cross-validation ont été appliqué sur différentes versions du système ANT.

***Modèle d (LOC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.754 | 0.567 | 0.924 | 0.731 | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | 0.754 | 0.733 | 0.773 | 0.753 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.651 | 0.633 | 0.667 | 0.650 | 0.836 | 0.919 | 0.667 | 0.783 |
| Régression Logistique | 0.746 | 0.667 | 0.818 | 0.739 | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | 0.690 | 0.400 | 0.955 | 0.618 | 0.687 | 1.000 | 0.045 | 0.212 |
| ANN | 0.778 | 0.733 | 0.818 | **0.774** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.809 | 0.211 | 0.971 | 0.453 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.742 | 0.079 | 0.921 | 0.27 | 0.737 | 0.400 | 0.857 | 0.585 |
| Random Forest | 0.708 | 0.316 | 0.814 | *0.507* | 0.763 | 0.560 | 0.836 | **0.684** |
| Régression Logistique | 0.803 | 0.184 | 0.971 | 0.423 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.768 | 0.200 | 0.971 | 0.441 |
| ANN | 0.787 | 0.263 | 0.929 | 0.494 | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.686 | 0.226 | 0.947 | 0.463 | 0.697 | 0.464 | 0.920 | 0.653 |
| J48 | 0.700 | 0.708 | 0.695 | **0.701** | 0.768 | 0.765 | 0.770 | 0.767 |
| Random Forest | 0.669 | 0.519 | 0.754 | 0.626 | 0.768 | 0.799 | 0.738 | **0.768** |
| Régression Logistique | 0.696 | 0.292 | 0.925 | 0.52 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.652 | 0.075 | 0.979 | 0.271 | 0.683 | 0.436 | 0.920 | 0.633 |
| ANN | 0.727 | 0.585 | 0.807 | 0.687 | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.858 | 0.111 | 0.967 | 0.328 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.798 | 0.267 | 0.876 | *0.484* | 0.821 | 0.557 | 0.873 | **0.697** |
| Régression Logistique | 0.864 | 0.044 | 0.984 | 0.208 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.899 | 0.229 | 0.969 | *0.471* | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.905 | 0.000 | 0.999 | 0.000 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.854 | 0.200 | 0.921 | 0.429 | 0.852 | 0.465 | 0.910 | **0.650** |
| Régression Logistique | 0.911 | 0.143 | 0.991 | 0.376 | 0.889 | 0.248 | 0.985 | 0.494 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.876 | 0.089 | 0.994 | 0.297 |
| ANN | 0.905 | 0.014 | 0.997 | 0.118 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, Cbo) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.754 | 0.567 | 0.924 | 0.724 | 0.791 | 0.807 | 0.758 | 0.782 |
| J48 | 0.754 | 0.733 | 0.773 | 0.753 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.659 | 0.633 | 0.682 | 0.657 | 0.841 | 0.919 | 0.682 | 0.792 |
| Régression Logistique | 0.746 | 0.667 | 0.818 | 0.739 | 0.821 | 0.837 | 0.788 | **0.812** |
| SVM | 0.690 | 0.400 | 0.955 | 0.618 | 0.687 | 1.000 | 0.045 | 0.212 |
| ANN | 0.778 | 0.733 | 0.818 | **0.774** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.815 | 0.237 | 0.971 | 0.480 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.747 | 0.053 | 0.936 | 0.223 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.697 | 0.316 | 0.800 | *0.503* | 0.742 | 0.560 | 0.807 | **0.672** |
| Régression Logistique | 0.803 | 0.184 | 0.971 | 0.423 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.768 | 0.200 | 0.971 | 0.441 |
| ANN | 0.792 | 0.289 | 0.929 | 0.518 | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.686 | 0.226 | 0.947 | 0.463 | 0.697 | 0.464 | 0.920 | 0.653 |
| J48 | 0.700 | 0.708 | 0.695 | **0.701** | 0.768 | 0.765 | 0.770 | **0.767** |
| Random Forest | 0.652 | 0.509 | 0.733 | 0.611 | 0.765 | 0.804 | 0.727 | 0.765 |
| Régression Logistique | 0.696 | 0.292 | 0.925 | 0.520 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.652 | 0.075 | 0.979 | 0.271 | 0.686 | 0.441 | 0.920 | 0.637 |
| ANN | 0.727 | 0.585 | 0.807 | 0.687 | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.858 | 0.111 | 0.967 | 0.328 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.798 | 0.267 | 0.876 | *0.484* | 0.823 | 0.557 | 0.876 | **0.699** |
| Régression Logistique | 0.864 | 0.044 | 0.984 | 0.208 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.899 | 0.229 | 0.969 | *0.471* | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.905 | 0.000 | 0.999 | 0.000 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.846 | 0.214 | 0.911 | 0.442 | 0.856 | 0.535 | 0.904 | **0.695** |
| Régression Logistique | 0.911 | 0.143 | 0.991 | 0.376 | 0.889 | 0.248 | 0.985 | 0.494 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.875 | 0.089 | 0.993 | 0.297 |
| ANN | 0.905 | 0.014 | 0.997 | 0.118 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.754 | 0.567 | 0.924 | 0.724 | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | 0.746 | 0.733 | 0.758 | 0.745 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.611 | 0.617 | 0.606 | 0.611 | 0.826 | 0.919 | 0.636 | 0.765 |
| Régression Logistique | 0.746 | 0.667 | 0.818 | 0.739 | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | 0.690 | 0.400 | 0.955 | 0.618 | 0.692 | 1.000 | 0.061 | 0.247 |
| ANN | 0.778 | 0.733 | 0.818 | **0.774** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.815 | 0.237 | 0.971 | 0.480 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.747 | 0.053 | 0.936 | 0.223 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.708 | 0.342 | 0.807 | *0.525* | 0.753 | 0.580 | 0.814 | **0.687** |
| Régression Logistique | 0.803 | 0.184 | 0.971 | 0.423 | 0.779 | 0.260 | 0.964 | 0.501 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.763 | 0.180 | 0.971 | 0.418 |
| ANN | 0.787 | 0.263 | 0.929 | 0.494 | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.686 | 0.226 | 0.947 | 0.463 | 0.697 | 0.469 | 0.914 | 0.655 |
| J48 | 0.686 | 0.708 | 0.674 | **0.701** | 0.770 | 0.771 | 0.770 | **0.770** |
| Random Forest | 0.638 | 0.500 | 0.717 | 0.611 | 0.757 | 0.799 | 0.717 | 0.757 |
| Régression Logistique | 0.693 | 0.283 | 0.925 | 0.520 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.648 | 0.066 | 0.979 | 0.271 | 0.678 | 0.419 | 0.925 | 0.623 |
| ANN | 0.727 | 0.585 | 0.807 | 0.687 | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.861 | 0.111 | 0.971 | 0.328 | 0.826 | 0.131 | 0.964 | 0.355 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.804 | 0.244 | 0.886 | *0.465* | 0.829 | 0.541 | 0.886 | **0.692** |
| Régression Logistique | 0.861 | 0.022 | 0.984 | 0.147 | 0.832 | 0.098 | 0.977 | 0.309 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.826 | 0.049 | 0.980 | 0.219 |
| ANT 17 | Naïve Bayes | 0.898 | 0.214 | 0.969 | *0.455* | 0.888 | 0.356 | 0.967 | 0.587 |
| J48 | 0.905 | 0.000 | 0.995 | 0.000 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.851 | 0.200 | 0.919 | 0.429 | 0.856 | 0.505 | 0.908 | **0.677** |
| Régression Logistique | 0.911 | 0.143 | 0.991 | 0.376 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.875 | 0.069 | 0.996 | 0.262 |
| ANN | 0.905 | 0.014 | 0.997 | 0.118 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.746 | 0.733 | 0.758 | 0.745 | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | 0.754 | 0.733 | 0.773 | 0.753 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.659 | 0.633 | 0.682 | 0.657 | 0.841 | 0.919 | 0.682 | 0.792 |
| Régression Logistique | 0.746 | 0.667 | 0.818 | 0.739 | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | 0.690 | 0.400 | 0.955 | 0.618 | 0.692 | 0.993 | 0.076 | 0.275 |
| ANN | 0.778 | 0.733 | 0.818 | **0.774** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.815 | 0.237 | 0.971 | 0.480 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.747 | 0.053 | 0.936 | 0.223 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.697 | 0.289 | 0.807 | *0.525* | 0.753 | 0.560 | 0.821 | **0.678** |
| Régression Logistique | 0.803 | 0.184 | 0.971 | 0.423 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.774 | 0.220 | 0.971 | 0.462 |
| ANN | 0.781 | 0.263 | 0.921 | 0.494 | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.686 | 0.226 | 0.947 | 0.463 | 0.694 | 0.464 | 0.914 | 0.651 |
| J48 | 0.686 | 0.708 | 0.674 | **0.691** | 0.768 | 0.765 | 0.770 | **0.767** |
| Random Forest | 0.655 | 0.528 | 0.727 | 0.620 | 0.762 | 0.810 | 0.717 | 0.762 |
| Régression Logistique | 0.696 | 0.292 | 0.925 | 0.520 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.652 | 0.075 | 0.979 | 0.271 | 0.686 | 0.441 | 0.920 | 0.637 |
| ANN | 0.727 | 0.585 | 0.807 | 0.687 | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.858 | 0.111 | 0.967 | 0.328 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.801 | 0.289 | 0.876 | *0.503* | 0.829 | 0.557 | 0.883 | **0.701** |
| Régression Logistique | 0.864 | 0.044 | 0.984 | 0.208 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.898 | 0.214 | 0.969 | 0.455 | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.905 | 0.000 | 0.999 | 0.000 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.864 | 0.243 | 0.929 | *0.475* | 0.862 | 0.545 | 0.910 | **0.704** |
| Régression Logistique | 0.911 | 0.143 | 0.991 | 0.376 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.875 | 0.079 | 0.994 | 0.280 |
| ANN | 0.905 | 0.014 | 0.997 | 0.118 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (Qi, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.627 | 0.650 | 0.606 | 0.628 | 0.642 | 0.933 | 0.045 | 0.205 |
| J48 | 0.690 | 0.833 | 0.561 | **0.684** | 0.801 | 0.919 | 0.561 | **0.718** |
| Random Forest | 0.548 | 0.483 | 0.606 | 0.541 | 0.776 | 0.874 | 0.576 | 0.710 |
| Régression Logistique | 0.563 | 0.167 | 0.924 | 0.393 | 0.682 | 0.993 | 0.045 | 0.211 |
| SVM | 0.508 | 0.000 | 0.970 | 0.000 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.595 | 0.500 | 0.682 | 0.584 | 0.761 | 0.911 | 0.455 | 0.644 |
| **ANT 14** | Naïve Bayes | 0.770 | 0.026 | 0.971 | 0.159 | 0.732 | 0.060 | 0.971 | 0.241 |
| J48 | 0.787 | 0.079 | 0.979 | 0.278 | 0.747 | 0.420 | 0.864 | 0.602 |
| Random Forest | 0.719 | 0.211 | 0.857 | 0.425 | 0.774 | 0.560 | 0.850 | **0.690** |
| Régression Logistique | 0.775 | 0.026 | 0.979 | 0.160 | 0.732 | 0.060 | 0.971 | 0.241 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.803 | 0.342 | 0.929 | *0.564* | 0.800 | 0.500 | 0.907 | 0.673 |
| **ANT 15** | Naïve Bayes | 0.635 | 0.028 | 0.979 | 0.166 | 0.552 | 0.128 | 0.957 | 0.350 |
| J48 | 0.717 | 0.547 | 0.813 | **0.667** | 0.735 | 0.654 | 0.813 | 0.729 |
| Random Forest | 0.669 | 0.434 | 0.802 | 0.590 | 0.732 | 0.665 | 0.797 | 0.728 |
| Régression Logistique | 0.628 | 0.038 | 0.963 | 0.191 | 0.697 | 0.525 | 0.861 | 0.672 |
| SVM | 0.635 | 0.000 | 0.995 | 0.000 | 0.530 | 0.050 | 0.989 | 0.222 |
| ANN | 0.683 | 0.368 | 0.861 | 0.563 | 0.746 | 0.687 | 0.802 | **0.742** |
| ANT 16 | Naïve Bayes | 0.866 | 0.000 | 0.993 | 0.000 | 0.821 | 0.000 | 0.984 | 0.000 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.838 | 0.156 | 0.938 | *0.383* | 0.851 | 0.443 | 0.932 | **0.643** |
| Régression Logistique | 0.869 | 0.022 | 0.993 | 0.148 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANT 17 | Naïve Bayes | 0.898 | 0.014 | 0.990 | *0.118* | 0.870 | 0.079 | 0.988 | 0.279 |
| J48 | 0.906 | 0.000 | 1.000 | 0.000 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.883 | 0.014 | 0.973 | *0.117* | 0.885 | 0.376 | 0.961 | **0.601** |
| Régression Logistique | 0.906 | 0.014 | 0.999 | *0.118* | 0.872 | 0.050 | 0.996 | 0.223 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN | 0.906 | 0.000 | 1.000 | 0.000 | 0.860 | 0.050 | 0.981 | 0.221 |

***Modèle d (Qi, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.468 | 0.867 | 0.106 | 0.303 | 0.612 | 0.881 | 0.061 | 0.232 |
| J48 | 0.579 | 0.733 | 0.439 | 0.567 | 0.756 | 0.919 | 0.424 | 0.624 |
| Random Forest | 0.651 | 0.567 | 0.727 | **0.642** | 0.806 | 0.867 | 0.682 | **0.769** |
| Régression Logistique | 0.508 | 0.017 | 0.955 | 0.127 | 0.672 | 1.000 | 0.000 | 0.000 |
| SVM | 0.524 | 0.000 | 1.000 | 0.000 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.492 | 0.233 | 0.727 | 0.412 | 0.672 | 1.000 | 0.000 | 0.000 |
| **ANT 14** | Naïve Bayes | 0.775 | 0.026 | 0.979 | 0.16 | 0.726 | 0.020 | 0.979 | 0.140 |
| J48 | 0.826 | 0.553 | 0.900 | **0.705** | 0.826 | 0.640 | 0.893 | **0.756** |
| Random Forest | 0.815 | 0.474 | 0.907 | 0.656 | 0.795 | 0.580 | 0.871 | 0.711 |
| Régression Logistique | 0.781 | 0.026 | 0.986 | 0.160 | 0.732 | 0.040 | 0.979 | 0.198 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.770 | 0.184 | 0.929 | 0.413 | 0.768 | 0.380 | 0.907 | 0.587 |
| **ANT 15** | Naïve Bayes | 0.628 | 0.000 | 0.984 | 0.000 | 0.555 | 0.134 | 0.957 | 0.358 |
| J48 | 0.584 | 0.387 | 0.695 | 0.519 | 0.683 | 0.765 | 0.604 | 0.680 |
| Random Forest | 0.669 | 0.453 | 0.791 | **0.599** | 0.732 | 0.715 | 0.749 | **0.732** |
| Régression Logistique | 0.628 | 0.000 | 0.984 | 0.000 | 0.571 | 0.179 | 0.947 | 0.412 |
| SVM | 0.635 | 0.000 | 0.995 | 0.000 | 0.522 | 0.034 | 0.989 | 0.183 |
| ANN | 0.625 | 0.019 | 0.968 | 0.136 | 0.626 | 0.419 | 0.824 | 0.588 |
| ANT 16 | Naïve Bayes | 0.869 | 0.000 | 0.997 | 0.000 | 0.826 | 0.000 | 0.990 | 0.000 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.829 | 0.000 | 0.993 | 0.000 |
| Random Forest | 0.830 | 0.044 | 0.945 | 0.204 | 0.845 | 0.377 | 0.938 | **0.595** |
| Régression Logistique | 0.869 | 0.000 | 0.997 | 0.000 | 0.829 | 0.000 | 0.993 | 0.000 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.823 | 0.000 | 0.987 | 0.000 |
| ANT 17 | Naïve Bayes | 0.899 | 0.000 | 0.993 | 0.000 | 0.870 | 0.069 | 0.990 | 0.261 |
| J48 | 0.906 | 0.000 | 1.000 | 0.000 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.887 | 0.014 | 0.978 | 0.117 | 0.865 | 0.168 | 0.969 | **0.403** |
| Régression Logistique | 0.905 | 0.000 | 0.999 | 0.000 | 0.866 | 0.000 | 0.996 | 0.000 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.870 | 0.000 | 1.000 | 0.000 |
| ANN | 0.906 | 0.000 | 1.000 | 0.000 | 0.870 | 0.030 | 0.996 | 0.173 |

***Modèle d (WMC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.516 | 0.150 | 0.848 | 0.357 | 0.657 | 0.941 | 0.076 | 0.267 |
| J48 | 0.571 | 0.617 | 0.530 | *0.572* | 0.677 | 0.807 | 0.409 | 0.575 |
| Random Forest | 0.579 | 0.500 | 0.652 | *0.571* | 0.711 | 0.822 | 0.485 | **0.631** |
| Régression Logistique | 0.579 | 0.217 | 0.909 | 0.444 | 0.667 | 0.985 | 0.015 | 0.122 |
| SVM | 0.524 | 0.017 | 0.985 | 0.129 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.556 | 0.333 | 0.758 | 0.502 | 0.692 | 0.919 | 0.227 | 0.457 |
| **ANT 14** | Naïve Bayes | 0.775 | 0.079 | 0.964 | 0.276 | 0.742 | 0.120 | 0.964 | 0.340 |
| J48 | 0.787 | 0.000 | 1.000 | 0.000 | 0.716 | 0.140 | 0.921 | 0.359 |
| Random Forest | 0.753 | 0.263 | 0.886 | *0.483* | 0.784 | 0.520 | 0.879 | **0.676** |
| Régression Logistique | 0.781 | 0.053 | 0.979 | 0.228 | 0.737 | 0.080 | 0.971 | 0.279 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.758 | 0.079 | 0.943 | 0.273 | 0.784 | 0.420 | 0.914 | 0.620 |
| **ANT 15** | Naïve Bayes | 0.638 | 0.057 | 0.968 | 0.235 | 0.552 | 0.123 | 0.963 | 0.344 |
| J48 | 0.635 | 0.406 | 0.765 | *0.557* | 0.702 | 0.642 | 0.759 | **0.698** |
| Random Forest | 0.577 | 0.311 | 0.727 | 0.475 | 0.675 | 0.687 | 0.663 | 0.675 |
| Régression Logistique | 0.635 | 0.038 | 0.973 | 0.192 | 0.617 | 0.385 | 0.840 | 0.569 |
| SVM | 0.635 | 0.000 | 0.995 | 0.000 | 0.525 | 0.039 | 0.989 | 0.196 |
| ANN | 0.645 | 0.170 | 0.914 | 0.394 | 0.678 | 0.564 | 0.786 | 0.666 |
| ANT 16 | Naïve Bayes | 0.864 | 0.044 | 0.984 | 0.208 | 0.815 | 0.000 | 0.977 | 0.000 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.823 | 0.033 | 0.980 | 0.180 |
| Random Forest | 0.801 | 0.067 | 0.909 | 0.247 | 0.815 | 0.344 | 0.909 | **0.559** |
| Régression Logistique | 0.869 | 0.022 | 0.993 | 0.148 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.826 | 0.000 | 0.990 | 0.000 |
| ANT 17 | Naïve Bayes | 0.895 | 0.014 | 0.987 | 0.118 | 0.866 | 0.079 | 0.984 | 0.279 |
| J48 | 0.906 | 0.000 | 1.000 | 0.000 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.866 | 0.071 | 0.948 | 0.259 | 0.880 | 0.426 | 0.948 | **0.635** |
| Régression Logistique | 0.905 | 0.000 | 0.999 | 0.000 | 0.872 | 0.040 | 0.997 | 0.200 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN | 0.905 | 0.000 | 0.999 | 0.000 | 0.867 | 0.020 | 0.994 | 0.141 |

***Modèle d (WMC, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.579 | 0.250 | 0.879 | 0.469 | 0.652 | 0.933 | 0.076 | 0.266 |
| J48 | 0.667 | 0.633 | 0.697 | 0.664 | 0.756 | 0.889 | 0.485 | 0.657 |
| Random Forest | 0.619 | 0.667 | 0.576 | 0.620 | 0.786 | 0.896 | 0.561 | **0.709** |
| Régression Logistique | 0.643 | 0.433 | 0.833 | 0.601 | 0.741 | 0.948 | 0.318 | 0.549 |
| SVM | 0.524 | 0.033 | 0.970 | 0.179 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.698 | 0.733 | 0.667 | **0.699** | 0.781 | 0.919 | 0.500 | 0.678 |
| **ANT 14** | Naïve Bayes | 0.775 | 0.105 | 0.957 | 0.317 | 0.758 | 0.200 | 0.957 | 0.437 |
| J48 | 0.770 | 0.026 | 0.971 | 0.159 | 0.768 | 0.400 | 0.900 | 0.600 |
| Random Forest | 0.742 | 0.263 | 0.871 | *0.479* | 0.784 | 0.600 | 0.850 | **0.714** |
| Régression Logistique | 0.781 | 0.132 | 0.957 | 0.355 | 0.753 | 0.200 | 0.950 | 0.436 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.726 | 0.000 | 0.986 | 0.000 |
| ANN | 0.809 | 0.395 | 0.921 | **0.603** | 0.784 | 0.480 | 0.893 | 0.655 |
| **ANT 15** | Naïve Bayes | 0.662 | 0.132 | 0.963 | 0.357 | 0.604 | 0.223 | 0.968 | 0.465 |
| J48 | 0.689 | 0.575 | 0.754 | **0.658** | 0.724 | 0.715 | 0.733 | 0.724 |
| Random Forest | 0.638 | 0.443 | 0.749 | 0.576 | 0.724 | 0.726 | 0.722 | **0.724** |
| Régression Logistique | 0.662 | 0.160 | 0.947 | 0.389 | 0.730 | 0.615 | 0.840 | 0.719 |
| SVM | 0.638 | 0.009 | 0.995 | 0.095 | 0.587 | 0.190 | 0.968 | 0.429 |
| ANN | 0.717 | 0.481 | 0.850 | 0.639 | 0.727 | 0.665 | 0.786 | 0.723 |
| ANT 16 | Naïve Bayes | 0.858 | 0.044 | 0.977 | 0.207 | 0.815 | 0.016 | 0.974 | 0.125 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.997 | 0.016 | 0.126 |
| Random Forest | 0.813 | 0.178 | 0.906 | 0.402 | 0.837 | 0.475 | 0.909 | **0.657** |
| Régression Logistique | 0.866 | 0.022 | 0.990 | 0.148 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.818 | 0.000 | 0.980 | 0.000 |
| ANT 17 | Naïve Bayes | 0.898 | 0.043 | 0.987 | 0.206 | 0.869 | 0.079 | 0.987 | 0.279 |
| J48 | 0.906 | 0.000 | 1.000 | 0.000 | 0.865 | 0.168 | 0.969 | 0.403 |
| Random Forest | 0.874 | 0.229 | 0.941 | 0.464 | 0.883 | 0.535 | 0.935 | **0.707** |
| Régression Logistique | 0.905 | 0.014 | 0.997 | 0.118 | 0.875 | 0.079 | 0.994 | 0.280 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN | 0.906 | 0.000 | 1.000 | 0.000 | 0.865 | 0.089 | 0.981 | 0.295 |

***Modèle d (WMC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.683 | 0.450 | 0.894 | 0.634 | 0.697 | 0.630 | 0.833 | 0.724 |
| J48 | 0.675 | 0.667 | 0.682 | **0.674** | 0.766 | 0.830 | 0.636 | 0.727 |
| Random Forest | 0.643 | 0.600 | 0.682 | 0.64 | 0.826 | 0.919 | 0.636 | **0.765** |
| Régression Logistique | 0.698 | 0.583 | 0.803 | 0.684 | 0.781 | 0.837 | 0.667 | 0.747 |
| SVM | 0.635 | 0.267 | 0.970 | 0.509 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.675 | 0.617 | 0.727 | 0.670 | 0.771 | 0.896 | 0.515 | 0.679 |
| **ANT 14** | Naïve Bayes | 0.809 | 0.263 | 0.957 | 0.502 | 0.800 | 0.360 | 0.957 | 0.587 |
| J48 | 0.758 | 0.132 | 0.929 | 0.35 | 0.789 | 0.400 | 0.929 | 0.610 |
| Random Forest | 0.708 | 0.263 | 0.829 | *0.467* | 0.753 | 0.560 | 0.821 | **0.678** |
| Régression Logistique | 0.809 | 0.211 | 0.971 | 0.453 | 0.800 | 0.360 | 0.957 | 0.587 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.753 | 0.060 | 1.000 | 0.245 |
| ANN | 0.792 | 0.211 | 0.950 | 0.448 | 0.789 | 0.400 | 0.929 | 0.610 |
| **ANT 15** | Naïve Bayes | 0.700 | 0.321 | 0.914 | 0.542 | 0.705 | 0.497 | 0.904 | 0.670 |
| J48 | 0.741 | 0.604 | 0.818 | **0.703** | 0.773 | 0.726 | 0.818 | **0.771** |
| Random Forest | 0.652 | 0.434 | 0.775 | 0.580 | 0.770 | 0.737 | 0.802 | 0.769 |
| Régression Logistique | 0.720 | 0.396 | 0.904 | 0.598 | 0.760 | 0.642 | 0.872 | 0.748 |
| SVM | 0.679 | 0.179 | 0.963 | 0.415 | 0.730 | 0.547 | 0.904 | 0.703 |
| ANN | 0.741 | 0.566 | 0.840 | 0.690 | 0.770 | 0.732 | 0.**807** | 0.769 |
| ANT 16 | Naïve Bayes | 0.861 | 0.133 | 0.967 | 0.359 | 0.834 | 0.197 | 0.961 | 0.435 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.813 | 0.089 | 0.919 | 0.286 | 0.823 | 0.393 | 0.909 | **0.598** |
| Régression Logistique | 0.875 | 0.044 | 0.997 | 0.209 | 0.829 | 0.082 | 0.977 | 0.283 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.869 | 0.000 | 0.997 | 0.000 | 0.829 | 0.000 | 0.993 | 0.000 |
| ANT 17 | Naïve Bayes | 0.897 | 0.229 | 0.966 | 0.470 | 0.876 | 0.327 | 0.959 | 0.560 |
| J48 | 0.909 | 0.129 | 0.990 | 0.357 | 0.901 | 0.317 | 0.988 | 0.560 |
| Random Forest | 0.885 | 0.200 | 0.956 | 0.437 | 0.876 | 0.455 | 0.939 | **0.654** |
| Régression Logistique | 0.914 | 0.143 | 0.994 | 0.377 | 0.901 | 0.317 | 0.988 | 0.560 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.871 | 0.010 | 1.000 | 0.100 |
| ANN | 0.913 | 0.129 | 0.994 | 0.358 | 0.894 | 0.287 | 0.985 | 0.532 |

***Modèle d (WMC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.579 | 0.283 | 0.848 | 0.490 | 0.637 | 0.911 | 0.076 | 0.263 |
| J48 | 0.643 | 0.817 | 0.485 | **0.629** | 0.736 | 0.881 | 0.439 | 0.622 |
| Random Forest | 0.571 | 0.533 | 0.606 | 0.568 | 0.741 | 0.852 | 0.515 | **0.662** |
| Régression Logistique | 0.532 | 0.133 | 0.894 | 0.345 | 0.672 | 0.985 | 0.030 | 0.172 |
| SVM | 0.508 | 0.000 | 0.970 | 0.000 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.603 | 0.500 | 0.697 | 0.590 | 0.731 | 0.926 | 0.333 | 0.555 |
| **ANT 14** | Naïve Bayes | 0.781 | 0.053 | 0.979 | 0.228 | 0.742 | 0.080 | 0.979 | 0.280 |
| J48 | 0.775 | 0.184 | 0.936 | 0.415 | 0.779 | 0.660 | 0.821 | **0.736** |
| Random Forest | 0.792 | 0.421 | 0.893 | **0.613** | 0.805 | 0.600 | 0.879 | 0.726 |
| Régression Logistique | 0.792 | 0.079 | 0.986 | 0.279 | 0.742 | 0.080 | 0.979 | 0.280 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.726 | 0.000 | 0.986 | 0.000 |
| ANN | 0.787 | 0.316 | 0.914 | 0.537 | 0.816 | 0.580 | 0.900 | 0.722 |
| **ANT 15** | Naïve Bayes | 0.625 | 0.000 | 0.979 | 0.000 | 0.566 | 0.140 | 0.973 | 0.369 |
| J48 | 0.679 | 0.679 | 0.679 | **0.679** | 0.727 | 0.765 | 0.690 | **0.727** |
| Random Forest | 0.662 | 0.434 | 0.791 | 0.586 | 0.721 | 0.737 | 0.706 | 0.721 |
| Régression Logistique | 0.625 | 0.019 | 0.968 | 0.136 | 0.615 | 0.313 | 0.904 | 0.532 |
| SVM | 0.635 | 0.000 | 0.995 | 0.000 | 0.519 | 0.034 | 0.984 | 0.183 |
| ANN | 0.669 | 0.226 | 0.920 | 0.456 | 0.694 | 0.642 | 0.743 | 0.691 |
| ANT 16 | Naïve Bayes | 0.869 | 0.000 | 0.997 | 0.000 | 0.826 | 0.000 | 0.990 | 0.000 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.016 | 0.997 | 0.126 |
| Random Forest | 0.807 | 0.111 | 0.909 | 0.318 | 0.815 | 0.426 | 0.893 | **0.617** |
| Régression Logistique | 0.866 | 0.000 | 0.993 | 0.000 | 0.826 | 0.000 | 0.990 | 0.000 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.000 | 1.000 | 0.000 | 0.832 | 0.033 | 0.990 | 0.181 |
| ANT 17 | Naïve Bayes | 0.898 | 0.014 | 0.990 | 0.118 | 0.863 | 0.069 | 0.982 | 0.260 |
| J48 | 0.906 | 0.000 | 1.000 | 0.000 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.867 | 0.071 | 0.950 | 0.260 | 0.880 | 0.406 | 0.951 | **0.621** |
| Régression Logistique | 0.903 | 0.000 | 0.997 | 0.000 | 0.871 | 0.040 | 0.996 | 0.200 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.870 | 0.000 | 1.000 | 0.000 |
| ANN | 0.906 | 0.000 | 1.000 | 0.000 | 0.869 | 0.000 | 0.999 | 0.000 |

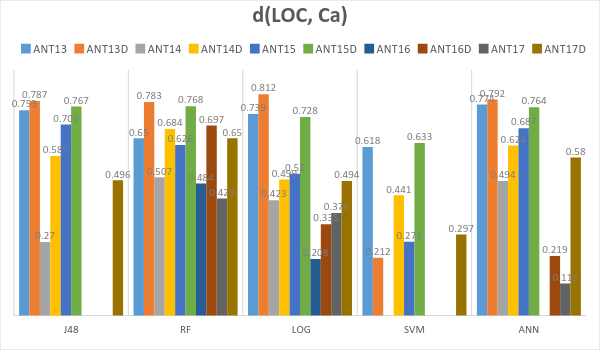
***Combinaison de Tous les Modèles :***

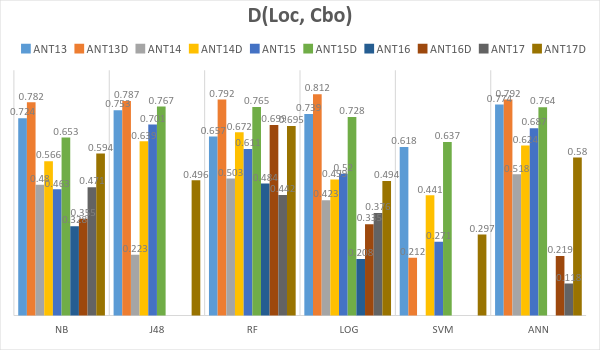
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.706 | 0.550 | 0.848 | 0.683 | 0.756 | 0.696 | 0.879 | 0.782 |
| J48 | 0.738 | 0.633 | 0.833 | 0.726 | 0.791 | 0.852 | 0.667 | 0.754 |
| Random Forest | 0.738 | 0.717 | 0.758 | 0.737 | 0.866 | 0.919 | 0.758 | **0.835** |
| Régression Logistique | 0.778 | 0.733 | 0.818 | **0.774** | 0.806 | 0.852 | 0.712 | 0.779 |
| SVM | 0.738 | 0.550 | 0.909 | 0.707 | 0.826 | 0.830 | 0.818 | 0.824 |
| ANN | 0.762 | 0.700 | 0.818 | 0.757 | 0.821 | 0.874 | 0.712 | 0.789 |
| **ANT 14** | Naïve Bayes | 0.775 | 0.368 | 0.886 | 0.571 | 0.784 | 0.480 | 0.893 | 0.655 |
| J48 | 0.803 | 0.500 | 0.886 | **0.666** | 0.789 | 0.620 | 0.850 | 0.726 |
| Random Forest | 0.775 | 0.368 | 0.886 | 0.571 | 0.842 | 0.660 | 0.907 | **0.774** |
| Régression Logistique | 0.792 | 0.289 | 0.929 | 0.518 | 0.779 | 0.420 | 0.907 | 0.617 |
| SVM | 0.781 | 0.000 | 0.993 | 0.000 | 0.758 | 0.200 | 0.957 | 0.437 |
| ANN | 0.820 | 0.368 | 0.943 | 0.589 | 0.811 | 0.520 | 0.914 | 0.689 |
| **ANT 15** | Naïve Bayes | 0.689 | 0.349 | 0.882 | 0.555 | 0.675 | 0.413 | 0.925 | 0.618 |
| J48 | 0.734 | 0.566 | 0.829 | 0.685 | 0.787 | 0.743 | 0.829 | 0.785 |
| Random Forest | 0.775 | 0.651 | 0.845 | **0.742** | 0.820 | 0.810 | 0.829 | **0.819** |
| Régression Logistique | 0.754 | 0.500 | 0.898 | 0.670 | 0.781 | 0.693 | 0.866 | 0.775 |
| SVM | 0.696 | 0.302 | 0.920 | 0.527 | 0.735 | 0.587 | 0.877 | 0.717 |
| ANN | 0.717 | 0.453 | 0.866 | 0.626 | 0.773 | 0.704 | 0.840 | 0.769 |
| ANT 16 | Naïve Bayes | 0.821 | 0.222 | 0.909 | 0.449 | 0.791 | 0.328 | 0.883 | 0.538 |
| J48 | 0.866 | 0.000 | 0.993 | 0.000 | 0.834 | 0.443 | 0.912 | 0.636 |
| Random Forest | 0.849 | 0.044 | 0.967 | 0.206 | 0.861 | 0.443 | 0.945 | **0.647** |
| Régression Logistique | 0.861 | 0.044 | 0.980 | 0.208 | 0.823 | 0.213 | 0.945 | 0.449 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.866 | 0.044 | 0.987 | 0.208 | 0.840 | 0.262 | 0.954 | 0.500 |
| ANT 17 | Naïve Bayes | 0.867 | 0.300 | 0.926 | *0.527* | 0.869 | 0.376 | 0.942 | 0.595 |
| J48 | 0.917 | 0.143 | 0.997 | 0.378 | 0.897 | 0.307 | 0.985 | 0.550 |
| Random Forest | 0.906 | 0.143 | 0.985 | 0.375 | 0.918 | 0.475 | 0.984 | **0.684** |
| Régression Logistique | 0.905 | 0.186 | 0.979 | 0.427 | 0.894 | 0.356 | 0.975 | 0.589 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.888 | 0.188 | 0.993 | 0.432 |
| ANN | 0.910 | 0.100 | 0.994 | 0.315 | 0.899 | 0.297 | 0.990 | 0.542 |

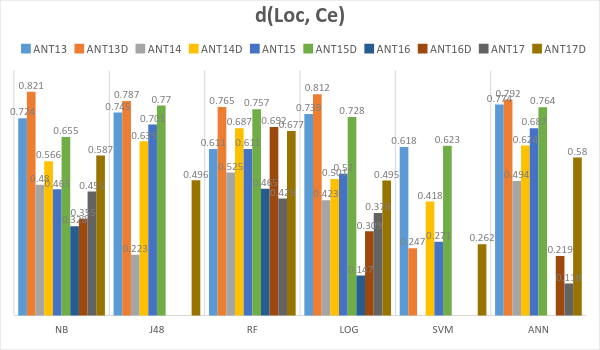
***Combinaison Sans les Qi:***

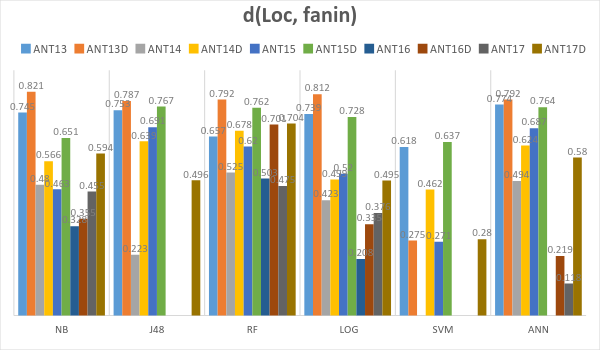
|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.722 | 0.567 | 0.864 | 0.700 | 0.761 | 0.704 | 0.879 | 0.787 |
| J48 | 0.746 | 0.733 | 0.758 | 0.745 | 0.811 | 0.874 | 0.682 | 0.772 |
| Random Forest | 0.698 | 0.717 | 0.682 | 0.699 | 0.861 | 0.933 | 0.712 | **0.815** |
| Régression Logistique | 0.762 | 0.683 | 0.833 | 0.754 | 0.811 | 0.844 | 0.742 | 0.791 |
| SVM | 0.738 | 0.550 | 0.909 | 0.707 | 0.811 | 0.800 | 0.833 | **0.816** |
| ANN | 0.770 | 0.717 | 0.818 | **0.766** | 0.821 | 0.881 | 0.697 | 0.784 |
| **ANT 14** | Naïve Bayes | 0.781 | 0.421 | 0.879 | **0.608** | 0.774 | 0.440 | 0.893 | 0.627 |
| J48 | 0.787 | 0.184 | 0.950 | 0.418 | 0.784 | 0.560 | 0.864 | 0.696 |
| Random Forest | 0.775 | 0.263 | 0.914 | 0.490 | 0.832 | 0.680 | 0.886 | **0.776** |
| Régression Logistique | 0.787 | 0.184 | 0.950 | 0.418 | 0.774 | 0.340 | 0.929 | 0.562 |
| SVM | 0.787 | 0.000 | 1.000 | 0.000 | 0.753 | 0.180 | 0.957 | 0.415 |
| ANN | 0.781 | 0.237 | 0.929 | 0.469 | 0.779 | 0.520 | 0.871 | 0.673 |
| **ANT 15** | Naïve Bayes | 0.706 | 0.396 | 0.882 | 0.591 | 0.686 | 0.464 | 0.898 | 0.646 |
| J48 | 0.754 | 0.604 | 0.840 | **0.712** | 0.806 | 0.726 | 0.882 | 0.800 |
| Random Forest | 0.717 | 0.594 | 0.786 | 0.683 | 0.801 | 0.816 | 0.786 | **0.801** |
| Régression Logistique | 0.727 | 0.472 | 0.872 | 0.642 | 0.760 | 0.687 | 0.829 | 0.755 |
| SVM | 0.696 | 0.302 | 0.920 | 0.527 | 0.746 | 0.609 | 0.877 | 0.731 |
| ANN | 0.720 | 0.509 | 0.840 | 0.654 | 0.776 | 0.737 | 0.813 | 0.774 |
| ANT 16 | Naïve Bayes | 0.824 | 0.267 | 0.906 | 0.492 | 0.807 | 0.377 | 0.893 | 0.580 |
| J48 | 0.872 | 0.000 | 1.000 | 0.000 | 0.823 | 0.098 | 0.967 | 0.308 |
| Random Forest | 0.844 | 0.067 | 0.958 | 0.253 | 0.856 | 0.443 | 0.938 | **0.645** |
| Régression Logistique | 0.872 | 0.089 | 0.987 | 0.296 | 0.829 | 0.131 | 0.967 | 0.356 |
| SVM | 0.872 | 0.000 | 1.000 | 0.000 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.872 | 0.022 | 0.997 | 0.148 | 0.834 | 0.197 | 0.961 | 0.435 |
| ANT 17 | Naïve Bayes | 0.808 | 0.557 | 0.834 | **0.682** | 0.870 | 0.455 | 0.932 | 0.651 |
| J48 | 0.918 | 0.157 | 0.997 | 0.396 | 0.902 | 0.287 | 0.994 | 0.534 |
| Random Forest | 0.903 | 0.157 | 0.981 | 0.392 | 0.911 | 0.505 | 0.972 | **0.701** |
| Régression Logistique | 0.910 | 0.186 | 0.985 | 0.428 | 0.896 | 0.356 | 0.976 | 0.589 |
| SVM | 0.906 | 0.000 | 1.000 | 0.000 | 0.890 | 0.208 | 0.993 | 0.454 |
| ANN | 0.909 | 0.100 | 0.993 | 0.315 | 0.898 | 0.287 | 0.990 | 0.533 |

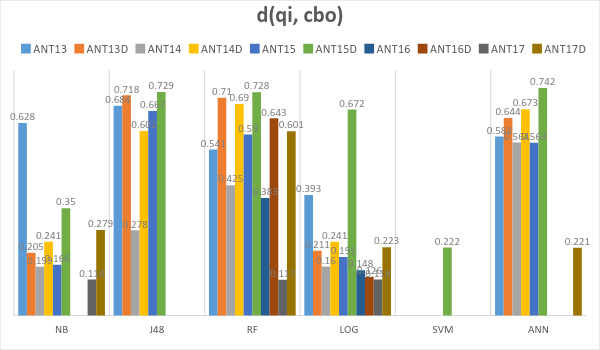
**Histogrammes**

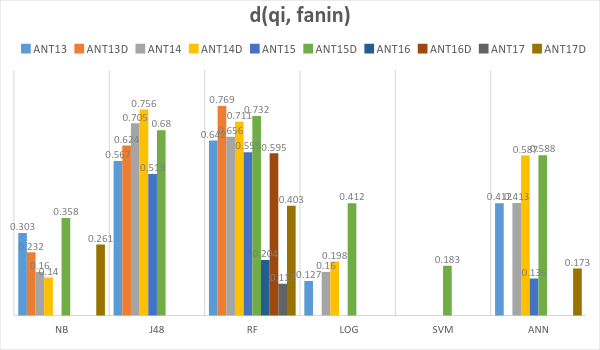


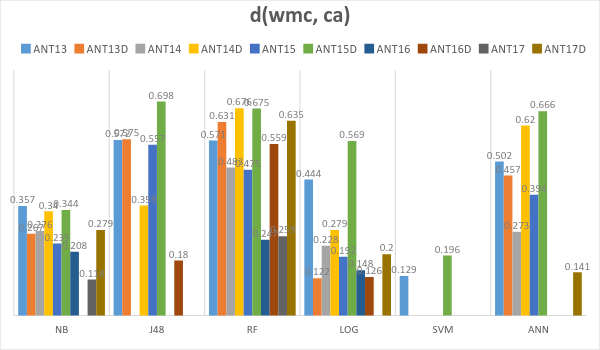


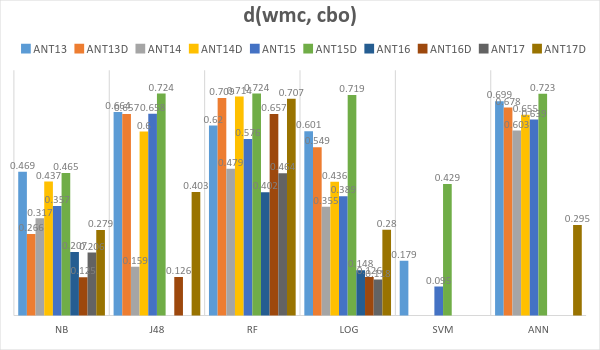


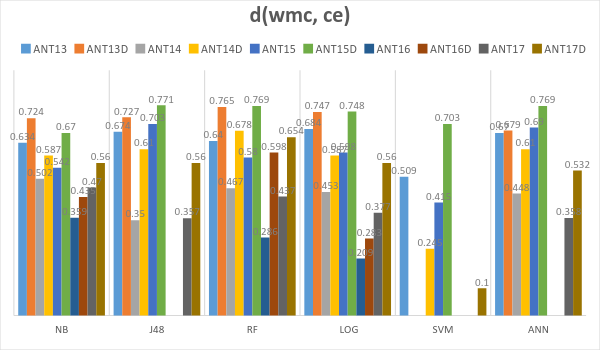


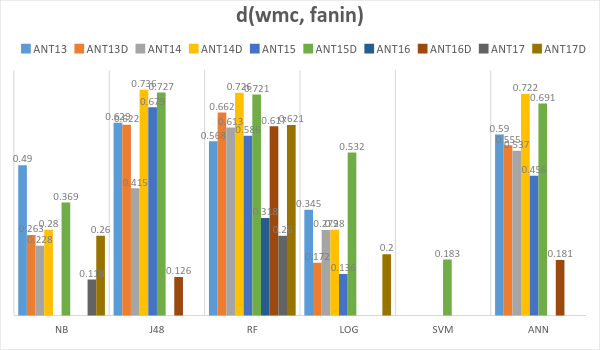


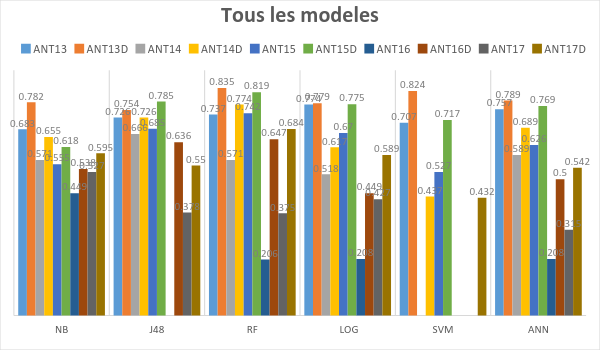


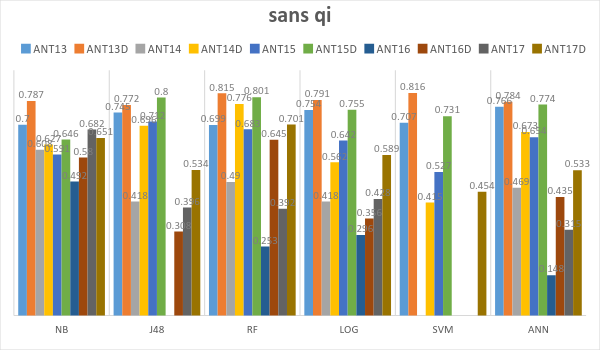


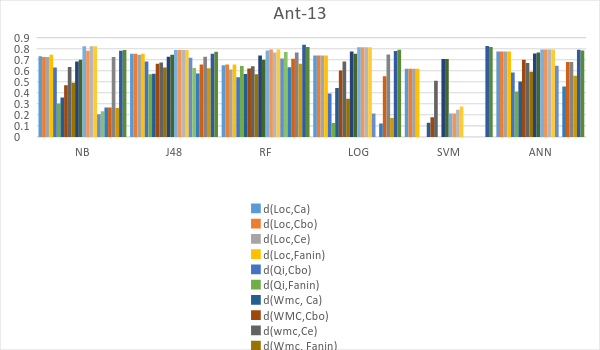


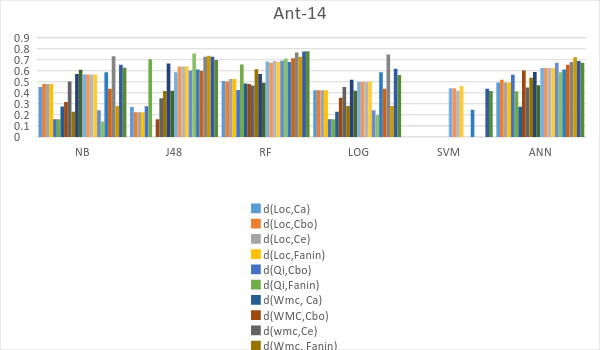


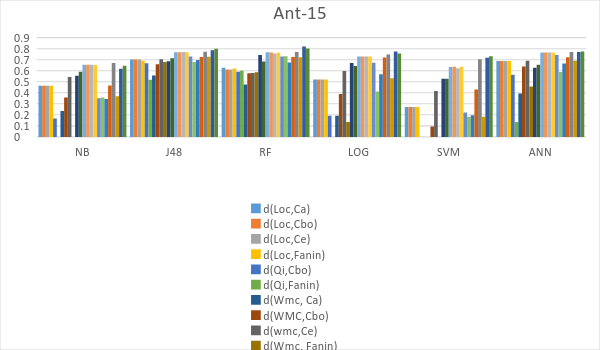


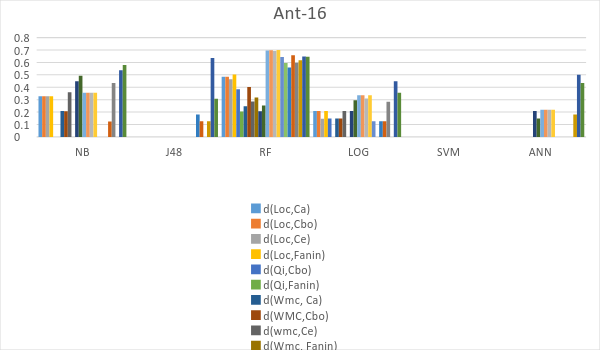


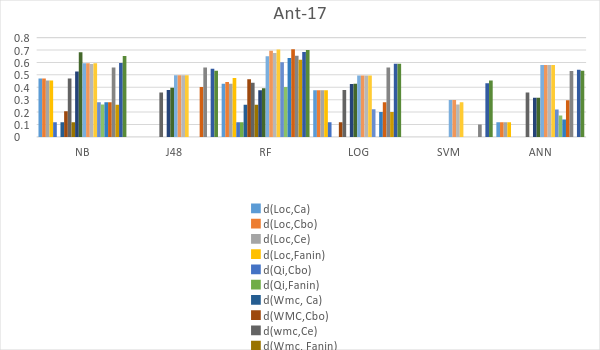












AnnMAx L

Ant 13

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| d(Loc, Ca) | 0.730 | 0.684 | 0.827 | 0.772 | 0.876 | 0.873 | 0.752 | 0.818 |
| d(Loc, Cbo) | 0.730 | 0.684 | 0.827 | 0.772 | 0.876 | 0.873 | 0.752 | 0.818 |
| d(Loc, Ce) | 0.731 | 0.686 | 0.826 | 0.772 | 0.876 | 0.873 | 0.752 | 0.818 |
| d(Loc, Fanin) | 0.731 | 0.686 | 0.826 | 0.772 | 0.873 | 0.875 | 0.732 | 0.817 |
| d(Qi, Cbo) | 0.273 | 0.184 | 0.849 | 0.567 | 0.820 | 0.949 | 0.258 | 0.643 |
| d(Qi, Fanin) | 0.120 | 0.069 | 0.920 | 0.316 | 0.804 | 1.000 | 0.000 | 0.000 |
| d(Wmc, Ca) | 0.309 | 0.210 | 0.867 | 0.532 | 0.794 | 0.947 | 0.100 | 0.436 |
| d(Wmc, Cbo) | 0.486 | 0.393 | 0.798 | 0.698 | 0.837 | 0.920 | 0.429 | 0.675 |
| d(Wmc, Ce) | 0.606 | 0.532 | 0.797 | 0.674 | 0.831 | 0.870 | 0.540 | 0.691 |
| d(Wmc, Fanin) | 0.279 | 0.193 | 0.829 | 0.510 | 0.816 | 0.965 | 0.179 | 0.560 |
| ALL | 0.617 | 0.510 | 0.871 | 0.768 | 0.868 | 0.874 | 0.717 | 0.795 |
| NoQi | 0.735 | 0.694 | 0.823 | 0.766 | 0.874 | 0.879 | 0.729 | 0.805 |

Ant 14

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| d(Loc, Ca) | 0.245 | 0.159 | 0.962 | 0.476 | 0.487 | 0.408 | 0.904 | 0.620 |
| d(Loc, Cbo) | 0.245 | 0.159 | 0.962 | 0.476 | 0.486 | 0.407 | 0.904 | 0.619 |
| d(Loc, Ce) | 0.245 | 0.159 | 0.962 | 0.476 | 0.487 | 0.408 | 0.904 | 0.620 |
| d(Loc, Fanin) | 0.243 | 0.158 | 0.961 | 0.474 | 0.487 | 0.408 | 0.904 | 0.620 |
| d(Qi, Cbo) | 0.131 | 0.077 | 0.970 | 0.518 | 0.473 | 0.376 | 0.923 | 0.662 |
| d(Qi, Fanin) | 0.030 | 0.016 | 0.982 | 0.276 | 0.254 | 0.165 | 0.952 | 0.492 |
| d(Wmc, Ca) | 0.083 | 0.048 | 0.971 | 0.315 | 0.387 | 0.287 | 0.931 | 0.545 |
| d(Wmc, Cbo) | 0.218 | 0.142 | 0.956 | 0.564 | 0.547 | 0.466 | 0.915 | 0.662 |
| d(Wmc, Ce) | 0.308 | 0.210 | 0.959 | 0.450 | 0.475 | 0.366 | 0.938 | 0.600 |
| d(Wmc, Fanin) | 0.151 | 0.092 | 0.966 | 0.440 | 0.450 | 0.358 | 0.917 | 0.662 |
| ALL | 0.369 | 0.273 | 0.943 | 0.539 | 0.520 | 0.444 | 0.905 | 0.669 |
| NoQi | 0.264 | 0.177 | 0.955 | 0.461 | 0.485 | 0.421 | 0.887 | 0.626 |

Ant 15

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| d(Loc, Ca) | 0.589 | 0.532 | 0.844 | 0.683 | 0.760 | 0.740 | 0.797 | 0.770 |
| d(Loc, Cbo) | 0.589 | 0.532 | 0.844 | 0.683 | 0.760 | 0.740 | 0.797 | 0.770 |
| d(Loc, Ce) | 0.584 | 0.522 | 0.850 | 0.685 | 0.760 | 0.740 | 0.797 | 0.770 |
| d(Loc, Fanin) | 0.593 | 0.539 | 0.841 | 0.681 | 0.760 | 0.740 | 0.797 | 0.770 |
| d(Qi, Cbo) | 0.267 | 0.175 | 0.923 | 0.562 | 0.683 | 0.616 | 0.820 | 0.741 |
| d(Qi, Fanin) | 0.000 | 0.000 | 0.986 | 0.000 | 0.334 | 0.227 | 0.874 | 0.541 |
| d(Wmc, Ca) | 0.086 | 0.048 | 0.961 | 0.347 | 0.583 | 0.493 | 0.811 | 0.665 |
| d(Wmc, Cbo) | 0.518 | 0.423 | 0.880 | 0.644 | 0.697 | 0.639 | 0.815 | 0.733 |
| d(Wmc, Ce) | 0.588 | 0.520 | 0.860 | 0.676 | 0.756 | 0.724 | 0.817 | 0.775 |
| d(Wmc, Fanin) | 0.099 | 0.055 | 0.970 | 0.400 | 0.559 | 0.457 | 0.830 | 0.697 |
| ALL | 0.558 | 0.484 | 0.859 | 0.656 | 0.748 | 0.713 | 0.815 | 0.769 |
| NoQi | 0.571 | 0.501 | 0.855 | 0.660 | 0.747 | 0.718 | 0.806 | 0.765 |

Ant 16

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| d(Loc, Ca) | 0.000 | 0.000 | 0.996 | 0.000 | 0.106 | 0.061 | 0.982 | 0.258 |
| d(Loc, Cbo) | 0.000 | 0.000 | 0.996 | 0.000 | 0.106 | 0.061 | 0.982 | 0.258 |
| d(Loc, Ce) | 0.000 | 0.000 | 0.996 | 0.000 | 0.116 | 0.067 | 0.982 | 0.266 |
| d(Loc, Fanin) | 0.000 | 0.000 | 0.996 | 0.000 | 0.106 | 0.061 | 0.982 | 0.254 |
| d(Qi, Cbo) | 0.007 | 0.003 | 0.999 | 0.101 | 0.000 | 0.000 | 0.993 | 0.000 |
| d(Qi, Fanin) | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.996 | 0.000 |
| d(Wmc, Ca) | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.995 | 0.000 |
| d(Wmc, Cbo) | 0.015 | 0.008 | 0.998 | 0.125 | 0.020 | 0.011 | 0.980 | 0.142 |
| d(Wmc, Ce) | 0.037 | 0.019 | 0.997 | 0.188 | 0.055 | 0.031 | 0.981 | 0.213 |
| d(Wmc, Fanin) | 0.000 | 0.000 | 1.000 | 0.000 | 0.000 | 0.000 | 0.995 | 0.000 |
| ALL | 0.000 | 0.000 | 0.998 | 0.000 | 0.167 | 0.102 | 0.976 | 0.412 |
| NoQi | 0.024 | 0.012 | 0.999 | 0.161 | 0.193 | 0.120 | 0.976 | 0.448 |

Ant 17

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| d(Loc, Ca) | 0.185 | 0.109 | 0.994 | 0.346 | 0.422 | 0.310 | 0.976 | 0.555 |
| d(Loc, Cbo) | 0.187 | 0.110 | 0.994 | 0.347 | 0.422 | 0.311 | 0.975 | 0.555 |
| d(Loc, Ce) | 0.190 | 0.112 | 0.993 | 0.350 | 0.422 | 0.311 | 0.975 | 0.555 |
| d(Loc, Fanin) | 0.185 | 0.109 | 0.994 | 0.346 | 0.421 | 0.310 | 0.976 | 0.555 |
| d(Qi, Cbo) | 0.000 | 0.000 | 0.999 | 0.000 | 0.129 | 0.0745 | 0.987 | 0.296 |
| d(Qi, Fanin) | 0.000 | 0.000 | 1.000 | 0.000 | 0.020 | 0.010 | 0.997 | 0.172 |
| d(Wmc, Ca) | 0.000 | 0.000 | 0.999 | 0.000 | 0.089 | 0.048 | 0.995 | 0.222 |
| d(Wmc, Cbo) | 0.000 | 0.000 | 0.998 | 0.000 | 0.164 | 0.102 | 0.979 | 0.341 |
| d(Wmc, Ce) | 0.153 | 0.086 | 0.996 | 0.360 | 0.417 | 0.282 | 0.990 | 0.531 |
| d(Wmc, Fanin) | 0.000 | 0.000 | 0.999 | 0.000 | 0.054 | 0.029 | 0.996 | 0.180 |
| ALL | 0.127 | 0.071 | 0.995 | 0.332 | 0.441 | 0.317 | 0.982 | 0.574 |
| NoQi | 0.188 | 0.112 | 0.992 | 0.345 | 0.449 | 0.323 | 0.983 | 0.582 |

Comparaison Avec Les Métriques

Après une utilisation de l’ACP ; RFC Ca et Loc ont étées retenus. Les résultats suivants sont obtenus à partir du système Ant15 :

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.737 | 0.425 | 0.914 | 0.623 | 0.746 | 0.570 | 0.914 | 0.722 |
| J48 | 0.785 | 0.623 | 0.877 | **0.739** | 0.817 | 0.749 | 0.882 | 0.813 |
| Random Forest | 0.761 | 0.623 | 0.840 | 0.723 | 0.822 | 0.804 | 0.840 | **0.822** |
| Régression Logistique | 0.765 | 0.491 | 0.920 | 0.672 | 0.809 | 0.737 | 0.877 | 0.804 |
| SVM | 0.734 | 0.368 | 0.941 | 0.588 | 0.779 | 0.615 | 0.936 | 0.759 |
| ANN | 0.775 | 0.594 | 0.877 | 0.722 | 0.820 | 0.788 | 0.850 | 0.818 |

Imbrication ACP ANT15

*d(Loc, d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.655 | 0.142 | 0.947 | 0.367 | 0.675 | 0.402 | 0.936 | 0.613 |
| J48 | 0.703 | 0.764 | 0.668 | **0.714** | 0.781 | 0.799 | 0.765 | **0.782** |
| Random Forest | 0.645 | 0.491 | 0.733 | 0.600 | 0.743 | 0.804 | 0.684 | 0.742 |
| Régression Logistique | 0.672 | 0.189 | 0.947 | 0.423 | 0.732 | 0.570 | 0.888 | 0.711 |
| SVM | 0.638 | 0.038 | 0.979 | 0.193 | 0.631 | 0.296 | 0.952 | 0.531 |
| ANN | 0.514 | 0.418 | 0.881 | 0.624 | 0.726 | 0.675 | 0.824 | 0.759 |

*d(Loc,RFC,Ca)*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.686 | 0.226 | 0.947 | 0.463 | 0.699 | 0.469 | 0.920 | 0.657 |
| J48 | 0.686 | 0.708 | 0.674 | **0.691** | 0.770 | 0.771 | 0.770 | **0.770** |
| Random Forest | 0.645 | 0.491 | 0.733 | 0.600 | 0.746 | 0.782 | 0.711 | 0.746 |
| Régression Logistique | 0.696 | 0.292 | 0.925 | 0.520 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.648 | 0.066 | 0.979 | 0.254 | 0.686 | 0.441 | 0.920 | 0.637 |
| ANN | 0.592 | 0.539 | 0.841 | 0.682 | 0.758 | 0.740 | 0.797 | **0.770** |

*d(d(Loc, Ce), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.689 | 0.226 | 0.952 | 0.464 | 0.697 | 0.464 | 0.920 | 0.653 |
| J48 | 0.686 | 0.708 | 0.674 | **0.691** | 0.776 | 0.788 | 0.765 | 0.776 |
| Random Forest | 0.662 | 0.519 | 0.743 | 0.621 | 0.754 | 0.799 | 0.776 | **0.787** |
| Régression Logistique | 0.693 | 0.283 | 0.925 | 0.512 | 0.738 | 0.609 | 0.861 | 0.724 |
| SVM | 0.648 | 0.066 | 0.979 | 0.254 | 0.678 | 0.413 | 0.930 | 0.620 |
| ANN | 0.586 | 0.527 | 0.847 | 0.683 | 0.758 | 0.739 | 0.798 | 0.770 |

*d(d(Loc, WMC), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.686 | 0.217 | 0.952 | 0.455 | 0.697 | 0.469 | 0.914 | 0.655 |
| J48 | 0.693 | 0.708 | 0.684 | **0.696** | 0.768 | 0.771 | 0.765 | 0.768 |
| Random Forest | 0.652 | 0.509 | 0.733 | 0.611 | 0.760 | 0.793 | 0.727 | 0.759 |
| Régression Logistique | 0.689 | 0.274 | 0.925 | 0.503 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.693 | 0.283 | 0.925 | 0.512 | 0.680 | 0.425 | 0.925 | 0.627 |
| ANN | 0.587 | 0.528 | 0.847 | 0.683 | 0.757 | 0.738 | 0.798 | **0.770** |

*d(d(Loc, RFC), d(Loc, Ca), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.703 | 0.321 | 0.920 | 0.543 | 0.705 | 0.497 | 0.904 | 0.670 |
| J48 | 0.693 | 0.679 | 0.701 | 0.690 | 0.768 | 0.771 | 0.765 | 0.768 |
| Random Forest | 0.631 | 0.481 | 0.717 | 0.587 | 0.760 | 0.788 | 0.733 | 0.760 |
| Régression Logistique | 0.703 | 0.340 | 0.909 | 0.556 | 0.749 | 0.637 | 0.856 | 0.738 |
| SVM | 0.662 | 0.151 | 0.952 | 0.379 | 0.735 | 0.581 | 0.882 | 0.716 |
| ANN | 0.649 | 0.650 | 0.800 | **0.728** | 0.764 | 0.751 | 0.794 | **0.778** |

ANT16

*d(Loc, d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.861 | 0.111 | 0.971 | 0.328 | 0.826 | 0.131 | 0.964 | 0.356 |
| J48 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Random Forest | 0.801 | 0.222 | 0.886 | 0.444 | 0.821 | 0.541 | 0.876 | **0.688** |
| Régression Logistique | 0.861 | 0.022 | 0.984 | 0.148 | 0.832 | 0.098 | 0.977 | 0.31 |
| SVM | 0.872 | 0 | 1 | 0 | 0.834 | 0 | 1 | 0 |
| ANN | 0.869 | 0 | 0.996 | 0 | 0.831 | 0.067 | 0.982 | 0.266 |

*d(Loc,RFC,Ca)*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.858 | 0.111 | 0.967 | 0.328 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0 | 0 | 1 | **0** | 0 | 0 | 1 | **0** |
| Random Forest | 0.79 | 0.267 | 0.866 | 0.481 | 0.813 | 0.541 | 0.866 | 0.685 |
| Régression Logistique | 0.864 | 0.044 | 0.984 | 0.209 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.872 | 0 | 1 | 0 | 0.834 | 0 | 1 | 0 |
| ANN | 0.869 | 0 | 0.996 | 0 | 0.829 | 0.059 | 0.982 | **0.258** |

*d(d(Loc, Ce), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.858 | 0.111 | 0.967 | 0.328 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0 | 0 | 1 | **0** | 0 | 0 | 1 | 0 |
| Random Forest | 0.798 | 0.267 | 0.876 | 0.483 | 0.826 | 0.541 | 0.883 | **0.691** |
| Régression Logistique | 0.861 | 0.022 | 0.984 | 0.148 | 0.832 | 0.098 | 0.977 | 0.31 |
| SVM | 0.872 | 0 | 1 | 0 | 0.834 | 0 | 1 | 0 |
| ANN | 0.869 | 0 | 0.996 | 0 | 0.832 | 0.073 | 0.982 | 0.279 |

*d(d(Loc, WMC), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.858 | 0.111 | 0.967 | 0.328 | 0.826 | 0.131 | 0.964 | 0.356 |
| J48 | 0 | 0 | 1 | **0** | 0 | 0 | 1 | 0 |
| Random Forest | 0.798 | 0.267 | 0.876 | 0.483 | 0.826 | 0.541 | 0.883 | **0.691** |
| Régression Logistique | 0.861 | 0.022 | 0.984 | 0.148 | 0.832 | 0.098 | 0.977 | 0.31 |
| SVM | 0.872 | 0 | 1 | 0 | 0.834 | 0 | 1 | 0 |
| ANN | 0.869 | 0 | 0.996 | 0 | 0.832 | 0.071 | 0.983 | 0.28 |

*d(d(Loc, RFC), d(Loc, Ca), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.849 | 0.111 | 0.958 | 0.326 | 0.818 | 0.148 | 0.951 | 0.375 |
| J48 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Random Forest | 0.81 | 0.267 | 0.889 | **0.487** | 0.837 | 0.557 | 0.893 | **0.705** |
| Régression Logistique | 0.866 | 0.067 | 0.984 | 0.256 | 0.837 | 0.131 | 0.977 | 0.358 |
| SVM | 0.872 | 0 | 1 | 0 | 0.834 | 0 | 1 | 0 |
| ANN | 0.871 | 0 | 0.999 | 0 | 0.826 | 0.025 | 0.986 | 0.172 |

ANT17

*d(Loc, d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.898 | 0.214 | 0.969 | 0.455 | 0.887 | 0.347 | 0.967 | 0.579 |
| J48 | 0.906 | 0.000 | 1.000 | 0 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.836 | 0.200 | 0.902 | 0.425 | 0.852 | 0.515 | 0.902 | **0.682** |
| Régression Logistique | 0.910 | 0.129 | 0.991 | 0.358 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.906 | 0.000 | 1.000 | 0 | 0.874 | 0.059 | 0.996 | 0.242 |
| ANN | 0.195 | 0.116 | 0.993 | 0.368 | 0.423 | 0.312 | 0.976 | 0.555 |

*d(Loc,RFC,Ca)*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.898 | 0.214 | 0.969 | 0.455 | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.906 | 0.000 | 1.000 | 0 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.840 | 0.171 | 0.910 | 0.394 | 0.853 | 0.485 | 0.908 | **0.664** |
| Régression Logistique | 0.911 | 0.143 | 0.991 | 0.376 | 0.889 | 0.248 | 0.985 | 0.494 |
| SVM | 0.906 | 0.000 | 1.000 | 0 | 0.875 | 0.089 | 0.993 | 0.297 |
| ANN | 0.188 | 0.110 | 0.993 | 0.364 | 0.421 | 0.310 | 0.976 | 0.555 |

*d(d(Loc, Ce), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.906 | 0.000 | 1.000 | 0 | 0.887 | 0.347 | 0.967 | 0.579 |
| J48 | 0.906 | 0.000 | 1.000 | 0 | 0.893 | 0.248 | 0.990 | 0.495 |
| Random Forest | 0.847 | 0.229 | 0.911 | 0.457 | 0.860 | 0.554 | 0.905 | **0.708** |
| Régression Logistique | 0.910 | 0.129 | 0.991 | 0.358 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.906 | 0.000 | 1.000 | 0 | 0.874 | 0.059 | 0.996 | 0.242 |
| ANN | 0.91 | 0.115 | 0.993 | 0.368 | 0.421 | 0.309 | 0.976 | 0.555 |

*d(d(Loc, WMC), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.898 | 0.214 | 0.969 | 0.455 | 0.888 | 0.356 | 0.967 | 0.587 |
| J48 | 0.906 | 0.000 | 1.000 | **0** | 0.893 | 0.248 | 0.990 | 0.495 |
| Random Forest | 0.844 | 0.200 | 0.911 | 0.427 | 0.856 | 0.525 | 0.905 | **0.689** |
| Régression Logistique | 0.910 | 0.129 | 0.991 | 0.358 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.906 | 0.000 | 1.000 | 0 | 0.875 | 0.069 | 0.996 | 0.262 |
| ANN | 0.91 | 0.115 | 0.993 | 0.368 | 0.89 | 0.31 | 0.976 | **0.555** |

*d(d(Loc, RFC), d(Loc, Ca), d(RFC,Ca))*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| Naïve Bayes | 0.897 | 0.271 | 0.961 | 0.51 | 0.884 | 0.386 | 0.959 | 0.608 |
| J48 | 0.906 | 0.000 | 1.000 | 0 | 0.893 | 0.248 | 0.990 | 0.495 |
| Random Forest | 0.852 | 0.229 | 0.917 | 0.458 | 0.858 | 0.505 | 0.911 | **0.678** |
| Régression Logistique | 0.910 | 0.143 | 0.990 | 0.376 | 0.889 | 0.277 | 0.981 | 0.521 |
| SVM | 0.906 | 0.000 | 1.000 | 0 | 0.876 | 0.099 | 0.993 | 0.314 |
| ANN | 0.909 | 0.095 | 0.994 | **0.345** | 0.889 | 0.31 | 0.975 | **0.555** |

Oversampling

Le tableau suivant décrit les différents systèmes Ant utilisés et met en évidence le nombre de classes, nombre de classes fautives ainsi que le ratio des classes fautives.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Système*** | ***#ClassesD*** | ***#FautivesD*** | ***%FautivesD*** | ***#ClassesB*** | ***#FautivesB*** | ***%FautivesB*** |
| Ant13 | 201 | 135 | 67.16% | 132 | 66 | 50.00% |
| Ant14 | 190 | 50 | 26.21% | 280 | 140 | 50.00% |
| Ant15 | 366 | 179 | 48.91% | 374 | 187 | 50.00% |
| Ant16 | 368 | 61 | 16.58% | 614 | 307 | 50.00% |
| Ant17 | 776 | 101 | 13.01% | 1350 | 675 | 50.00% |

***Modèle d (LOC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.750 | 0.712 | 0.788 | 0,749 | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | 0.712 | 0.712 | 0.712 | 0,712 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.659 | 0.652 | 0.667 | 0,659 | 0.836 | 0.919 | 0.667 | 0.783 |
| Régression Logistique | 0.773 | 0.727 | 0.818 | 0,771 | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | 0.697 | 0.455 | 0.939 | 0,654 | 0.687 | 1.000 | 0.045 | 0.212 |
| ANN | 0.744 | 0.715 | 0.793 | **0.780** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.668 | 0.471 | 0.864 | 0,638 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.686 | 0.579 | 0.793 | 0,678 | 0.737 | 0.400 | 0.857 | 0.585 |
| Random Forest | 0.657 | 0.671 | 0.643 | *0,657* | 0.763 | 0.560 | 0.836 | **0.684** |
| Régression Logistique | 0.696 | 0.636 | 0.757 | 0,694 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.693 | 0.557 | 0.829 | 0,680 | 0.768 | 0.200 | 0.971 | 0.441 |
| ANN | 0.629 | 0.614 | 0.662 | **0.699** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.666 | 0.487 | 0.845 | 0,641 | 0.697 | 0.464 | 0.920 | 0.653 |
| J48 | 0.719 | 0.807 | 0.631 | 0,714 | 0.768 | 0.765 | 0.770 | 0.767 |
| Random Forest | 0.623 | 0.610 | 0.636 | 0,623 | 0.768 | 0.799 | 0.738 | **0.768** |
| Régression Logistique | 0.695 | 0.545 | 0.845 | 0,679 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.636 | 0.342 | 0.930 | 0,564 | 0.683 | 0.436 | 0.920 | 0.633 |
| ANN | 0.701 | 0.694 | 0.713 | **0.725** | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.668 | 0.466 | 0.870 | 0,637 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.700 | 0.687 | 0.713 | **0,700** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.630 | 0.635 | 0.625 | *0,630* | 0.821 | 0.557 | 0.873 | **0.697** |
| Régression Logistique | 0.686 | 0.573 | 0.798 | 0,676 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.661 | 0.476 | 0.847 | 0,635 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.566 | 0.501 | 0.729 | 0.667 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.674 | 0.434 | 0.914 | *0.630* | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.760 | 0.788 | 0.732 | **0.759** | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.696 | 0.689 | 0.702 | 0.695 | 0.852 | 0.465 | 0.910 | **0.650** |
| Régression Logistique | 0.722 | 0.597 | 0.847 | 0.711 | 0.889 | 0.248 | 0.985 | 0.494 |
| SVM | 0.701 | 0.529 | 0.873 | 0.680 | 0.876 | 0.089 | 0.994 | 0.297 |
| ANN | 0.730 | 0.744 | 0.707 | 0.727 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, Cbo) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.750 | 0.591 | 0.909 | 0,733 | 0.791 | 0.807 | 0.758 | 0.782 |
| J48 | 0.735 | 0.697 | 0.773 | 0,734 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.667 | 0.667 | 0.667 | 0,667 | 0.841 | 0.919 | 0.682 | 0.792 |
| Régression Logistique | 0.773 | 0.727 | 0.818 | 0,771 | 0.821 | 0.837 | 0.788 | **0.812** |
| SVM | 0.705 | 0.455 | 0.955 | 0,659 | 0.687 | 1.000 | 0.045 | 0.212 |
| ANN | 0.744 | 0.715 | 0.793 | **0.779** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.686 | 0.507 | 0.864 | 0,662 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.696 | 0.600 | 0.793 | 0,690 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.657 | 0.664 | 0.650 | *0,657* | 0.742 | 0.560 | 0.807 | **0.672** |
| Régression Logistique | 0.7 | 0.643 | 0.757 | 0,698 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.696 | 0.557 | 0.836 | 0,682 | 0.768 | 0.200 | 0.971 | 0.441 |
| ANN | 0.631 | 0.614 | 0.669 | **0.705** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.655 | 0.465 | 0.845 | 0,627 | 0.697 | 0.464 | 0.920 | 0.653 |
| J48 | 0.733 | 0.786 | 0.679 | 0,731 | 0.768 | 0.765 | 0.770 | **0.767** |
| Random Forest | 0.628 | 0.626 | 0.631 | 0,628 | 0.765 | 0.804 | 0.727 | 0.765 |
| Régression Logistique | 0.693 | 0.540 | 0.845 | 0,675 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.634 | 0.337 | 0.930 | 0,560 | 0.686 | 0.441 | 0.920 | 0.637 |
| ANN | 0.722 | 0.727 | 0.715 | **0.732** | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.679 | 0.492 | 0.866 | 0,653 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.679 | 0.599 | 0.759 | **0,674** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.647 | 0.661 | 0.632 | *0,646* | 0.823 | 0.557 | 0.876 | **0.699** |
| Régression Logistique | 0.682 | 0.567 | 0.798 | 0,673 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.679 | 0.560 | 0.798 | 0,668 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.564 | 0.498 | 0.733 | 0.665 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.673 | 0.431 | 0.914 | *0.628* | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.752 | 0.761 | 0.742 | 0.751 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.709 | 0.726 | 0.692 | 0.709 | 0.856 | 0.535 | 0.904 | **0.695** |
| Régression Logistique | 0.724 | 0.601 | 0.847 | 0.713 | 0.889 | 0.248 | 0.985 | 0.494 |
| SVM | 0.700 | 0.527 | 0.873 | 0.678 | 0.875 | 0.089 | 0.993 | 0.297 |
| ANN | 0.734 | 0.748 | 0.710 | **0.731** | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.742 | 0.576 | 0.909 | 0,724 | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | 0.720 | 0.712 | 0.727 | 0,719 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.659 | 0.667 | 0.652 | 0,659 | 0.826 | 0.919 | 0.636 | 0.765 |
| Régression Logistique | 0.773 | 0.727 | 0.818 | 0,771 | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | 0.697 | 0.455 | 0.939 | 0,654 | 0.692 | 1.000 | 0.061 | 0.247 |
| ANN | 0.747 | 0.720 | 0.793 | **0.779** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.668 | 0.471 | 0.864 | 0,638 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.689 | 0.557 | 0.821 | 0,676 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.646 | 0.657 | 0.636 | *0,646* | 0.753 | 0.580 | 0.814 | **0.687** |
| Régression Logistique | 0.693 | 0.629 | 0.757 | 0,690 | 0.779 | 0.260 | 0.964 | 0.501 |
| SVM | 0.700 | 0.557 | 0.843 | 0,685 | 0.763 | 0.180 | 0.971 | 0.418 |
| ANN | 0.626 | 0.606 | 0.671 | **0.706** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.658 | 0.465 | 0.850 | 0,629 | 0.697 | 0.469 | 0.914 | 0.655 |
| J48 | 0.714 | 0.786 | 0.642 | 0,710 | 0.770 | 0.771 | 0.770 | **0.770** |
| Random Forest | 0.631 | 0.604 | 0.658 | 0,63 | 0.757 | 0.799 | 0.717 | 0.757 |
| Régression Logistique | 0.695 | 0.545 | 0.845 | 0,679 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.623 | 0.310 | 0.936 | 0,539 | 0.678 | 0.419 | 0.925 | 0.623 |
| ANN | 0.717 | 0.709 | 0.732 | **0.730** | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.671 | 0.476 | 0.866 | 0,642 | 0.826 | 0.131 | 0.964 | 0.355 |
| J48 | 0.689 | 0.678 | 0.700 | **0,689** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.661 | 0.655 | 0.668 | *0,661* | 0.829 | 0.541 | 0.886 | **0.692** |
| Régression Logistique | 0.684 | 0.570 | 0.798 | 0,674 | 0.832 | 0.098 | 0.977 | 0.309 |
| SVM | 0.668 | 0.472 | 0.863 | 0,638 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.826 | 0.049 | 0.980 | 0.219 |
| ANT 17 | Naïve Bayes | 0.674 | 0.433 | 0.916 | 0.630 | 0.888 | 0.356 | 0.967 | 0.587 |
| J48 | 0.748 | 0.733 | 0.763 | **0.748** | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.713 | 0.699 | 0.726 | 0.712 | 0.856 | 0.505 | 0.908 | **0.677** |
| Régression Logistique | 0.725 | 0.603 | 0.847 | 0.715 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.696 | 0.519 | 0.874 | 0.674 | 0.875 | 0.069 | 0.996 | 0.262 |
| ANN | 0.733 | 0.748 | 0.708 | 0.730 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.750 | 0.591 | 0.909 | 0,733 | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | 0.712 | 0.712 | 0.712 | 0,712 | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | 0.689 | 0.682 | 0.697 | 0,689 | 0.841 | 0.919 | 0.682 | 0.792 |
| Régression Logistique | 0.773 | 0.727 | 0.818 | 0,771 | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | 0.705 | 0.470 | 0.939 | 0,664 | 0.692 | 0.993 | 0.076 | 0.275 |
| ANN | 0.747 | 0.719 | 0.794 | **0.779** | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.679 | 0.493 | 0.864 | 0,653 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.696 | 0.593 | 0.800 | 0,689 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.657 | 0.650 | 0.664 | *0,657* | 0.753 | 0.560 | 0.821 | **0.678** |
| Régression Logistique | 0.693 | 0.629 | 0.757 | 0,690 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.711 | 0.593 | 0.829 | 0,701 | 0.774 | 0.220 | 0.971 | 0.462 |
| ANN | 0.689 | 0.668 | 0.730 | **0.703** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | 0.658 | 0.465 | 0.850 | 0,629 | 0.694 | 0.464 | 0.914 | 0.651 |
| J48 | 0.717 | 0.738 | 0.695 | 0,716 | 0.768 | 0.765 | 0.770 | **0.767** |
| Random Forest | 0.623 | 0.615 | 0.631 | 0,623 | 0.762 | 0.810 | 0.717 | 0.762 |
| Régression Logistique | 0.695 | 0.545 | 0.845 | 0,679 | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | 0.628 | 0.326 | 0.930 | 0,551 | 0.686 | 0.441 | 0.920 | 0.637 |
| ANN | 0.720 | 0.719 | 0.720 | **0.730** | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.673 | 0.476 | 0.870 | 0,644 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.710 | 0.651 | 0.769 | **0,708** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.678 | 0.668 | 0.687 | *0,677* | 0.829 | 0.557 | 0.883 | **0.701** |
| Régression Logistique | 0.687 | 0.577 | 0.798 | 0,679 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.666 | 0.489 | 0.844 | 0,642 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.673 | 0.431 | 0.914 | 0.628 | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.708 | 0.800 | 0.754 | **0.777** | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.699 | 0.702 | 0.695 | 0.698 | 0.862 | 0.545 | 0.910 | **0.704** |
| Régression Logistique | 0.722 | 0.597 | 0.847 | 0.711 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.701 | 0.529 | 0.873 | 0.680 | 0.875 | 0.079 | 0.994 | 0.280 |
| ANN |  |  |  |  | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (Qi, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.500 | 0.788 | 0.212 | 0,409 | 0.642 | 0.933 | 0.045 | 0.205 |
| J48 | 0.697 | 0.833 | 0.561 | 0,684 | 0.801 | 0.919 | 0.561 | **0.718** |
| Random Forest | 0.606 | 0.591 | 0.621 | 0,606 | 0.776 | 0.874 | 0.576 | 0.710 |
| Régression Logistique | 0.621 | 0.409 | 0.833 | 0,584 | 0.682 | 0.993 | 0.045 | 0.211 |
| SVM | 0.515 | 0.455 | 0.576 | 0,512 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.529 | 0.549 | 0.475 | **0.560** | 0.761 | 0.911 | 0.455 | 0.644 |
| **ANT 14** | Naïve Bayes | 0.664 | 0.564 | 0.764 | 0,656 | 0.732 | 0.060 | 0.971 | 0.241 |
| J48 | 0.700 | 0.736 | 0.664 | 0,699 | 0.747 | 0.420 | 0.864 | 0.602 |
| Random Forest | 0.743 | 0.657 | 0.829 | **0,738** | 0.774 | 0.560 | 0.850 | **0.690** |
| Régression Logistique | 0.693 | 0.543 | 0.843 | 0,677 | 0.732 | 0.060 | 0.971 | 0.241 |
| SVM | 0.518 | 0.064 | 0.971 | 0,249 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.686 | 0.671 | 0.714 | 0.725 | 0.800 | 0.500 | 0.907 | 0.673 |
| **ANT 15** | Naïve Bayes | 0.567 | 0.219 | 0.914 | 0,447 | 0.552 | 0.128 | 0.957 | 0.350 |
| J48 | 0.695 | 0.578 | 0.813 | 0,686 | 0.735 | 0.654 | 0.813 | 0.729 |
| Random Forest | 0.717 | 0.626 | 0.807 | **0,711** | 0.732 | 0.665 | 0.797 | 0.728 |
| Régression Logistique | 0.682 | 0.540 | 0.824 | 0,667 | 0.697 | 0.525 | 0.861 | 0.672 |
| SVM | 0.508 | 0.037 | 0.979 | 0,190 | 0.530 | 0.050 | 0.989 | 0.222 |
| ANN | 0.633 | 0.615 | 0.672 | 0.682 | 0.746 | 0.687 | 0.802 | **0.742** |
| ANT 16 | Naïve Bayes | 0.577 | 0.355 | 0.798 | 0,532 | 0.821 | 0.000 | 0.984 | 0.000 |
| J48 | 0.634 | 0.430 | 0.837 | 0,6 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.785 | 0.691 | 0.879 | **0,779** | 0.851 | 0.443 | 0.932 | **0.643** |
| Régression Logistique | 0.625 | 0.472 | 0.779 | 0,606 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.505 | 0.023 | 0.987 | 0,151 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.834 | 0.000 | 1.000 | 0.000 |
| ANT 17 | Naïve Bayes | 0.564 | 0.170 | 0.959 | *0.404* | 0.870 | 0.079 | 0.988 | 0.279 |
| J48 | 0.859 | 0.898 | 0.821 | 0.859 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.893 | 0.830 | 0.956 | **0.891** | 0.885 | 0.376 | 0.961 | **0.601** |
| Régression Logistique | 0.647 | 0.473 | 0.821 | 0.623 | 0.872 | 0.050 | 0.996 | 0.223 |
| SVM | 0.507 | 0.033 | 0.982 | 0.180 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN | 0.667 | 0.659 | 0.683 | 0.685 | 0.860 | 0.050 | 0.981 | 0.221 |

***Modèle d (Qi, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.485 | 0.909 | 0.061 | 0,235 | 0.612 | 0.881 | 0.061 | 0.232 |
| J48 | 0.591 | 0.758 | 0.424 | 0,567 | 0.756 | 0.919 | 0.424 | 0.624 |
| Random Forest | 0.712 | 0.621 | 0.803 | **0,706** | 0.806 | 0.867 | 0.682 | **0.769** |
| Régression Logistique | 0.462 | 0.409 | 0.515 | 0,459 | 0.672 | 1.000 | 0.000 | 0.000 |
| SVM | 0.477 | 0.470 | 0.485 | 0,477 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.536 | 0.593 | 0.383 | 0.482 | 0.672 | 1.000 | 0.000 | 0.000 |
| **ANT 14** | Naïve Bayes | 0.654 | 0.664 | 0.643 | 0,653 | 0.726 | 0.020 | 0.979 | 0.140 |
| J48 | 0.782 | 0.686 | 0.879 | 0,777 | 0.826 | 0.640 | 0.893 | **0.756** |
| Random Forest | 0.821 | 0.757 | 0.886 | **0,819** | 0.795 | 0.580 | 0.871 | 0.711 |
| Régression Logistique | 0.664 | 0.414 | 0.914 | 0,615 | 0.732 | 0.040 | 0.979 | 0.198 |
| SVM | 0.525 | 0.064 | 0.986 | 0,251 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.657 | 0.626 | 0.720 | 0.745 | 0.768 | 0.380 | 0.907 | 0.587 |
| **ANT 15** | Naïve Bayes | 0.532 | 0.118 | 0.947 | 0,334 | 0.555 | 0.134 | 0.957 | 0.358 |
| J48 | 0.610 | 0.583 | 0.636 | **0,609** | 0.683 | 0.765 | 0.604 | 0.680 |
| Random Forest | 0.586 | 0.503 | 0.668 | 0,580 | 0.732 | 0.715 | 0.749 | **0.732** |
| Régression Logistique | 0.604 | 0.390 | 0.818 | 0,565 | 0.571 | 0.179 | 0.947 | 0.412 |
| SVM | 0.508 | 0.027 | 0.989 | 0,163 | 0.522 | 0.034 | 0.989 | 0.183 |
| ANN | 0.530 | 0.579 | 0.429 | 0.514 | 0.626 | 0.419 | 0.824 | 0.588 |
| ANT 16 | Naïve Bayes | 0.485 | 0.853 | 0.117 | 0,316 | 0.826 | 0.000 | 0.990 | 0.000 |
| J48 | 0.787 | 0.681 | 0.893 | 0,780 | 0.829 | 0.000 | 0.993 | 0.000 |
| Random Forest | 0.819 | 0.723 | 0.915 | **0,813** | 0.845 | 0.377 | 0.938 | **0.595** |
| Régression Logistique | 0.573 | 0.280 | 0.866 | 0,492 | 0.829 | 0.000 | 0.993 | 0.000 |
| SVM | 0.493 | 0.300 | 0.687 | 0,454 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.823 | 0.000 | 0.987 | 0.000 |
| ANT 17 | Naïve Bayes | 0.496 | 0.961 | 0.031 | *0.173* | 0.870 | 0.069 | 0.990 | 0.261 |
| J48 | 0.808 | 0.764 | 0.852 | 0.807 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.840 | 0.766 | 0.914 | **0.837** | 0.865 | 0.168 | 0.969 | **0.403** |
| Régression Logistique | 0.557 | 0.267 | 0.847 | 0.476 | 0.866 | 0.000 | 0.996 | 0.000 |
| SVM | 0.521 | 0.170 | 0.873 | 0.385 | 0.870 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.870 | 0.030 | 0.996 | 0.173 |

***Modèle d (WMC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.500 | 0.182 | 0.818 | 0,386 | 0.657 | 0.941 | 0.076 | 0.267 |
| J48 | 0.598 | 0.667 | 0.530 | *0,595* | 0.677 | 0.807 | 0.409 | 0.575 |
| Random Forest | 0.591 | 0.545 | 0.636 | *0,589* | 0.711 | 0.822 | 0.485 | **0.631** |
| Régression Logistique | 0.591 | 0.394 | 0.788 | 0,557 | 0.667 | 0.985 | 0.015 | 0.122 |
| SVM | 0.470 | 0.470 | 0.470 | 0,470 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.522 | 0.520 | 0.528 | 0.555 | 0.692 | 0.919 | 0.227 | 0.457 |
| **ANT 14** | Naïve Bayes | 0.586 | 0.229 | 0.943 | 0,465 | 0.742 | 0.120 | 0.964 | 0.340 |
| J48 | 0.707 | 0.750 | 0.664 | **0,706** | 0.716 | 0.140 | 0.921 | 0.359 |
| Random Forest | 0.689 | 0.614 | 0.764 | *0,685* | 0.784 | 0.520 | 0.879 | **0.676** |
| Régression Logistique | 0.650 | 0.500 | 0.800 | 0,632 | 0.737 | 0.080 | 0.971 | 0.279 |
| SVM | 0.532 | 0.093 | 0.971 | 0,301 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.610 | 0.560 | 0.724 | 0.658 | 0.784 | 0.420 | 0.914 | 0.620 |
| **ANT 15** | Naïve Bayes | 0.532 | 0.118 | 0.947 | 0,334 | 0.552 | 0.123 | 0.963 | 0.344 |
| J48 | 0.610 | 0.583 | 0.636 | **0,609** | 0.702 | 0.642 | 0.759 | **0.698** |
| Random Forest | 0.586 | 0.503 | 0.668 | 0,580 | 0.675 | 0.687 | 0.663 | 0.675 |
| Régression Logistique | 0.604 | 0.390 | 0.818 | 0,565 | 0.617 | 0.385 | 0.840 | 0.569 |
| SVM | 0.508 | 0.027 | 0.989 | 0,163 | 0.525 | 0.039 | 0.989 | 0.196 |
| ANN | 0.548 | 0.534 | 0.584 | 0.600 | 0.678 | 0.564 | 0.786 | 0.666 |
| ANT 16 | Naïve Bayes | 0.542 | 0.130 | 0.954 | 0,352 | 0.815 | 0.000 | 0.977 | 0.000 |
| J48 | 0.570 | 0.339 | 0.801 | 0,521 | 0.823 | 0.033 | 0.980 | 0.180 |
| Random Forest | 0.700 | 0.625 | 0.775 | **0,696** | 0.815 | 0.344 | 0.909 | **0.559** |
| Régression Logistique | 0.586 | 0.384 | 0.788 | 0,550 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.503 | 0.020 | 0.987 | 0,140 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.826 | 0.000 | 0.990 | 0.000 |
| ANT 17 | Naïve Bayes | 0.518 | 0.068 | 0.967 | 0.256 | 0.866 | 0.079 | 0.984 | 0.279 |
| J48 | 0.658 | 0.720 | 0.596 | 0.655 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.763 | 0.684 | 0.841 | **0.758** | 0.880 | 0.426 | 0.948 | **0.635** |
| Régression Logistique | 0.592 | 0.332 | 0.852 | 0.532 | 0.872 | 0.040 | 0.997 | 0.200 |
| SVM | 0.508 | 0.024 | 0.993 | 0.154 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN |  |  |  |  | 0.867 | 0.020 | 0.994 | 0.141 |

***Modèle d (WMC, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.568 | 0.273 | 0.864 | 0,486 | 0.652 | 0.933 | 0.076 | 0.266 |
| J48 | 0.689 | 0.636 | 0.742 | 0,687 | 0.756 | 0.889 | 0.485 | 0.657 |
| Random Forest | 0.598 | 0.545 | 0.652 | 0,596 | 0.786 | 0.896 | 0.561 | **0.709** |
| Régression Logistique | 0.674 | 0.530 | 0.818 | 0,658 | 0.741 | 0.948 | 0.318 | 0.549 |
| SVM | 0.523 | 0.091 | 0.955 | 0,295 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.635 | 0.651 | 0.600 | **0.735** | 0.781 | 0.919 | 0.500 | 0.678 |
| **ANT 14** | Naïve Bayes | 0.646 | 0.379 | 0.914 | 0,589 | 0.758 | 0.200 | 0.957 | 0.437 |
| J48 | 0.704 | 0.743 | 0.664 | 0,702 | 0.768 | 0.400 | 0.900 | 0.600 |
| Random Forest | 0.668 | 0.650 | 0.686 | *0,668* | 0.784 | 0.600 | 0.850 | **0.714** |
| Régression Logistique | 0.700 | 0.593 | 0.807 | 0,692 | 0.753 | 0.200 | 0.950 | 0.436 |
| SVM | 0.639 | 0.343 | 0.936 | 0,567 | 0.726 | 0.000 | 0.986 | 0.000 |
| ANN | 0.691 | 0.671 | 0.728 | **0.725** | 0.784 | 0.480 | 0.893 | 0.655 |
| **ANT 15** | Naïve Bayes | 0.575 | 0.225 | 0.925 | 0,456 | 0.604 | 0.223 | 0.968 | 0.465 |
| J48 | 0.671 | 0.588 | 0.754 | 0,666 | 0.724 | 0.715 | 0.733 | 0.724 |
| Random Forest | 0.658 | 0.626 | 0.690 | 0,657 | 0.724 | 0.726 | 0.722 | **0.724** |
| Régression Logistique | 0.703 | 0.588 | 0.818 | **0,694** | 0.730 | 0.615 | 0.840 | 0.719 |
| SVM | 0.551 | 0.139 | 0.963 | 0,366 | 0.587 | 0.190 | 0.968 | 0.429 |
| ANN | 0.658 | 0.623 | 0.730 | 0.693 | 0.727 | 0.665 | 0.786 | 0.723 |
| ANT 16 | Naïve Bayes | 0.549 | 0.179 | 0.919 | 0,406 | 0.815 | 0.016 | 0.974 | 0.125 |
| J48 | 0.630 | 0.495 | 0.765 | 0,615 | 0.834 | 0.997 | 0.016 | 0.126 |
| Random Forest | 0.655 | 0.603 | 0.707 | **0,653** | 0.837 | 0.475 | 0.909 | **0.657** |
| Régression Logistique | 0.625 | 0.482 | 0.769 | 0,609 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.518 | 0.075 | 0.961 | 0,268 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.818 | 0.000 | 0.980 | 0.000 |
| ANT 17 | Naïve Bayes | 0.582 | 0.204 | 0.960 | *0.443* | 0.869 | 0.079 | 0.987 | 0.279 |
| J48 | 0.672 | 0.821 | 0.523 | 0.655 | 0.865 | 0.168 | 0.969 | 0.403 |
| Random Forest | 0.722 | 0.680 | 0.764 | **0.721** | 0.883 | 0.535 | 0.935 | **0.707** |
| Régression Logistique | 0.681 | 0.547 | 0.816 | 0.668 | 0.875 | 0.079 | 0.994 | 0.280 |
| SVM | 0.564 | 0.160 | 0.967 | 0.393 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN |  |  |  |  | 0.865 | 0.089 | 0.981 | 0.295 |

***Modèle d (WMC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.689 | 0.470 | 0.909 | 0,654 | 0.697 | 0.630 | 0.833 | 0.724 |
| J48 | 0.705 | 0.758 | 0.652 | 0,703 | 0.766 | 0.830 | 0.636 | 0.727 |
| Random Forest | 0.621 | 0.636 | 0.606 | 0,621 | 0.826 | 0.919 | 0.636 | **0.765** |
| Régression Logistique | 0.697 | 0.636 | 0.758 | 0,694 | 0.781 | 0.837 | 0.667 | 0.747 |
| SVM | 0.621 | 0.318 | 0.924 | 0,542 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.657 | 0.633 | 0.705 | **0.712** | 0.771 | 0.896 | 0.515 | 0.679 |
| **ANT 14** | Naïve Bayes | 0.679 | 0.507 | 0.850 | 0,656 | 0.800 | 0.360 | 0.957 | 0.587 |
| J48 | 0.707 | 0.764 | 0.650 | **0,705** | 0.789 | 0.400 | 0.929 | 0.610 |
| Random Forest | 0.686 | 0.671 | 0.700 | *0,685* | 0.753 | 0.560 | 0.821 | **0.678** |
| Régression Logistique | 0.693 | 0.621 | 0.764 | 0,689 | 0.800 | 0.360 | 0.957 | 0.587 |
| SVM | 0.686 | 0.529 | 0.843 | 0,668 | 0.753 | 0.060 | 1.000 | 0.245 |
| ANN | 0.672 | 0.636 | 0.743 | 0.687 | 0.789 | 0.400 | 0.929 | 0.610 |
| **ANT 15** | Naïve Bayes | 0.684 | 0.465 | 0.904 | 0,648 | 0.705 | 0.497 | 0.904 | 0.670 |
| J48 | 0.733 | 0.631 | 0.834 | **0,725** | 0.773 | 0.726 | 0.818 | **0.771** |
| Random Forest | 0.663 | 0.583 | 0.743 | 0,658 | 0.770 | 0.737 | 0.802 |  |
| Régression Logistique | 0.725 | 0.615 | 0.834 | 0,716 | 0.760 | 0.642 | 0.872 | 0.748 |
| SVM | 0.676 | 0.449 | 0.904 | 0,637 | 0.730 | 0.547 | 0.904 | 0.703 |
| ANN | 0.693 | 0.656 | 0.763 | 0.710 | 0.770 | 0.732 | 0.**807** | 0.769 |
| ANT 16 | Naïve Bayes | 0.634 | 0.410 | 0.857 | 0,593 | 0.834 | 0.197 | 0.961 | 0.435 |
| J48 | 0.695 | 0.759 | 0.632 | **0,693** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.673 | 0.612 | 0.733 | 0,670 | 0.823 | 0.393 | 0.909 | **0.598** |
| Régression Logistique | 0.643 | 0.511 | 0.775 | 0,629 | 0.829 | 0.082 | 0.977 | 0.283 |
| SVM | 0.653 | 0.479 | 0.827 | 0,629 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.829 | 0.000 | 0.993 | 0.000 |
| ANT 17 | Naïve Bayes | 0.649 | 0.419 | 0.879 | *0.607* | 0.876 | 0.327 | 0.959 | 0.560 |
| J48 | 0.717 | 0.615 | 0.819 | 0.710 | 0.901 | 0.317 | 0.988 | 0.560 |
| Random Forest | 0.776 | 0.720 | 0.833 | **0.774** | 0.876 | 0.455 | 0.939 | **0.654** |
| Régression Logistique | 0.714 | 0.631 | 0.797 | 0.709 | 0.901 | 0.317 | 0.988 | 0.560 |
| SVM | 0.712 | 0.591 | 0.833 | 0.702 | 0.871 | 0.010 | 1.000 | 0.100 |
| ANN |  |  |  |  | 0.894 | 0.287 | 0.985 | 0.532 |

***Modèle d (WMC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.545 | 0.712 | 0.379 | 0,519 | 0.637 | 0.911 | 0.076 | 0.263 |
| J48 | 0.644 | 0.758 | 0.530 | 0,634 | 0.736 | 0.881 | 0.439 | 0.622 |
| Random Forest | 0.583 | 0.485 | 0.682 | 0,575 | 0.741 | 0.852 | 0.515 | **0.662** |
| Régression Logistique | 0.576 | 0.333 | 0.818 | 0,522 | 0.672 | 0.985 | 0.030 | 0.172 |
| SVM | 0.500 | 0.152 | 0.848 | 0,359 | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | 0.523 | 0.519 | 0.535 | **0.581** | 0.731 | 0.926 | 0.333 | 0.555 |
| **ANT 14** | Naïve Bayes | 0.579 | 0.229 | 0.929 | 0,461 | 0.742 | 0.080 | 0.979 | 0.280 |
| J48 | 0.771 | 0.736 | 0.807 | **0,771** | 0.779 | 0.660 | 0.821 | **0.736** |
| Random Forest | 0.696 | 0.671 | 0.721 | *0,696* | 0.805 | 0.600 | 0.879 | 0.726 |
| Régression Logistique | 0.736 | 0.593 | 0.879 | 0,722 | 0.742 | 0.080 | 0.979 | 0.280 |
| SVM | 0.532 | 0.079 | 0.986 | 0,279 | 0.726 | 0.000 | 0.986 | 0.000 |
| ANN | 0.711 | 0.708 | 0.715 | 0.720 | 0.816 | 0.580 | 0.900 | 0.722 |
| **ANT 15** | Naïve Bayes | 0.553 | 0.160 | 0.947 | 0,389 | 0.566 | 0.140 | 0.973 | 0.369 |
| J48 | 0.698 | 0.722 | 0.674 | **0,698** | 0.727 | 0.765 | 0.690 | **0.727** |
| Random Forest | 0.650 | 0.588 | 0.711 | 0,647 | 0.721 | 0.737 | 0.706 | 0.721 |
| Régression Logistique | 0.607 | 0.348 | 0.866 | 0,549 | 0.615 | 0.313 | 0.904 | 0.532 |
| SVM | 0.503 | 0.021 | 0.984 | 0,144 | 0.519 | 0.034 | 0.984 | 0.183 |
| ANN | 0.593 | 0.600 | 0.575 | 0.656 | 0.694 | 0.642 | 0.743 | 0.691 |
| ANT 16 | Naïve Bayes | 0.562 | 0.547 | 0.577 | 0,562 | 0.826 | 0.000 | 0.990 | 0.000 |
| J48 | 0.598 | 0.349 | 0.847 | 0,544 | 0.834 | 0.016 | 0.997 | 0.126 |
| Random Forest | 0.695 | 0.616 | 0.775 | **0,691** | 0.815 | 0.426 | 0.893 | **0.617** |
| Régression Logistique | 0.588 | 0.322 | 0.853 | 0,524 | 0.826 | 0.000 | 0.990 | 0.000 |
| SVM | 0.505 | 0.023 | 0.987 | 0,151 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.832 | 0.033 | 0.990 | 0.181 |
| ANT 17 | Naïve Bayes | 0.583 | 0.335 | 0.831 | *0.528* | 0.863 | 0.069 | 0.982 | 0.260 |
| J48 | 0.655 | 0.656 | 0.653 | 0.654 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.758 | 0.689 | 0.827 | **0.755** | 0.880 | 0.406 | 0.951 | **0.621** |
| Régression Logistique | 0.605 | 0.393 | 0.818 | 0.567 | 0.871 | 0.040 | 0.996 | 0.200 |
| SVM | 0.502 | 0.025 | 0.979 | 0.156 | 0.870 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.869 | 0.000 | 0.999 | 0.000 |

***Combinaison de Tous les Modèles :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.705 | 0.561 | 0.848 | 0,690 | 0.756 | 0.696 | 0.879 | 0.782 |
| J48 | 0.765 | 0.667 | 0.864 | 0,759 | 0.791 | 0.852 | 0.667 | 0.754 |
| Random Forest | 0.773 | 0.758 | 0.788 | 0,773 | 0.866 | 0.919 | 0.758 | **0.835** |
| Régression Logistique | 0.773 | 0.727 | 0.818 | 0,771 | 0.806 | 0.852 | 0.712 | 0.779 |
| SVM | 0.758 | 0.606 | 0.909 | 0,742 | 0.826 | 0.830 | 0.818 | 0.824 |
| ANN | 0.765 | 0.722 | 0.835 | **0.782** | 0.821 | 0.874 | 0.712 | 0.789 |
| **ANT 14** | Naïve Bayes | 0.671 | 0.493 | 0.850 | 0,647 | 0.784 | 0.480 | 0.893 | 0.655 |
| J48 | 0.793 | 0.800 | 0.786 | 0,793 | 0.789 | 0.620 | 0.850 | 0.726 |
| Random Forest | 0.868 | 0.857 | 0.879 | **0,868** | 0.842 | 0.660 | 0.907 | **0.774** |
| Régression Logistique | 0.711 | 0.643 | 0.779 | 0,708 | 0.779 | 0.420 | 0.907 | 0.617 |
| SVM | 0.721 | 0.664 | 0.779 | 0,719 | 0.758 | 0.200 | 0.957 | 0.437 |
| ANN | 0.692 | 0.654 | 0.763 | 0.713 | 0.811 | 0.520 | 0.914 | 0.689 |
| **ANT 15** | Naïve Bayes | 0.663 | 0.439 | 0.888 | 0,624 | 0.675 | 0.413 | 0.925 | 0.618 |
| J48 | 0.751 | 0.727 | 0.775 | 0,751 | 0.787 | 0.743 | 0.829 | 0.785 |
| Random Forest | 0.802 | 0.781 | 0.824 | **0,802** | 0.820 | 0.810 | 0.829 | **0.819** |
| Régression Logistique | 0.711 | 0.620 | 0.802 | 0,705 | 0.781 | 0.693 | 0.866 | 0.775 |
| SVM | 0.674 | 0.471 | 0.877 | 0,643 | 0.735 | 0.587 | 0.877 | 0.717 |
| ANN | 0.696 | 0.660 | 0.763 | 0.712 | 0.773 | 0.704 | 0.840 | 0.769 |
| ANT 16 | Naïve Bayes | 0.640 | 0.423 | 0.857 | 0,602 | 0.791 | 0.328 | 0.883 | 0.538 |
| J48 | 0.785 | 0.847 | 0.723 | 0,783 | 0.834 | 0.443 | 0.912 | 0.636 |
| Random Forest | 0.871 | 0.902 | 0.840 | **0,870** | 0.861 | 0.443 | 0.945 | **0.647** |
| Régression Logistique | 0.656 | 0.547 | 0.765 | 0,647 | 0.823 | 0.213 | 0.945 | 0.449 |
| SVM | 0.676 | 0.531 | 0.821 | 0,66 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.840 | 0.262 | 0.954 | 0.500 |
| ANT 17 | Naïve Bayes |  |  |  |  | 0.869 | 0.376 | 0.942 | 0.595 |
| J48 |  |  |  |  | 0.897 | 0.307 | 0.985 | 0.550 |
| Random Forest |  |  |  |  | 0.918 | 0.475 | 0.984 | **0.684** |
| Régression Logistique |  |  |  |  | 0.894 | 0.356 | 0.975 | 0.589 |
| SVM |  |  |  |  | 0.888 | 0.188 | 0.993 | 0.432 |
| ANN |  |  |  |  | 0.899 | 0.297 | 0.990 | 0.542 |

***Combinaison Sans les Qi:***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | 0.727 | 0.591 | 0.864 | 0,715 | 0.761 | 0.704 | 0.879 | 0.787 |
| J48 | 0.720 | 0.712 | 0.727 | 0,719 | 0.811 | 0.874 | 0.682 | 0.772 |
| Random Forest | 0.720 | 0.727 | 0.712 | 0,719 | 0.861 | 0.933 | 0.712 | **0.815** |
| Régression Logistique | 0.765 | 0.697 | 0.833 | 0,762 | 0.811 | 0.844 | 0.742 | 0.791 |
| SVM | 0.750 | 0.606 | 0.894 | 0,736 | 0.811 | 0.800 | 0.833 | **0.816** |
| ANN | 0.760 | 0.718 | 0.828 | **0.778** | 0.821 | 0.881 | 0.697 | 0.784 |
| **ANT 14** | Naïve Bayes | 0.671 | 0.486 | 0.857 | 0,645 | 0.774 | 0.440 | 0.893 | 0.627 |
| J48 | 0.771 | 0.864 | 0.679 | 0,766 | 0.784 | 0.560 | 0.864 | 0.696 |
| Random Forest | 0.818 | 0.821 | 0.814 | **0,817** | 0.832 | 0.680 | 0.886 | **0.776** |
| Régression Logistique | 0.714 | 0.650 | 0.779 | 0,712 | 0.774 | 0.340 | 0.929 | 0.562 |
| SVM | 0.718 | 0.650 | 0.786 | 0,715 | 0.753 | 0.180 | 0.957 | 0.415 |
| ANN | 0.689 | 0.664 | 0.736 | 0.702 | 0.779 | 0.520 | 0.871 | 0.673 |
| **ANT 15** | Naïve Bayes | 0.668 | 0.460 | 0.877 | 0,635 | 0.686 | 0.464 | 0.898 | 0.646 |
| J48 | 0.725 | 0.636 | 0.813 | 0,719 | 0.806 | 0.726 | 0.882 | 0.800 |
| Random Forest | 0.746 | 0.749 | 0.743 | **0,746** | 0.801 | 0.816 | 0.786 | **0.801** |
| Régression Logistique | 0.725 | 0.610 | 0.840 | 0,716 | 0.760 | 0.687 | 0.829 | 0.755 |
| SVM | 0.679 | 0.481 | 0.877 | 0,649 | 0.746 | 0.609 | 0.877 | 0.731 |
| ANN | 0.693 | 0.657 | 0.761 | 0.710 | 0.776 | 0.737 | 0.813 | 0.774 |
| ANT 16 | Naïve Bayes | 0.647 | 0.446 | 0.847 | 0,615 | 0.807 | 0.377 | 0.893 | 0.580 |
| J48 | 0.779 | 0.866 | 0.691 | 0,774 | 0.823 | 0.098 | 0.967 | 0.308 |
| Random Forest | 0.816 | 0.821 | 0.811 | **0,816** | 0.856 | 0.443 | 0.938 | **0.645** |
| Régression Logistique | 0.664 | 0.56 | 0.769 | 0,656 | 0.829 | 0.131 | 0.967 | 0.356 |
| SVM | 0.679 | 0.537 | 0.821 | 0,664 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN |  |  |  |  | 0.834 | 0.197 | 0.961 | 0.435 |
| ANT 17 | Naïve Bayes |  |  |  |  | 0.870 | 0.455 | 0.932 | 0.651 |
| J48 |  |  |  |  | 0.902 | 0.287 | 0.994 | 0.534 |
| Random Forest |  |  |  |  | 0.911 | 0.505 | 0.972 | **0.701** |
| Régression Logistique |  |  |  |  | 0.896 | 0.356 | 0.976 | 0.589 |
| SVM |  |  |  |  | 0.890 | 0.208 | 0.993 | 0.454 |
| ANN |  |  |  |  | 0.898 | 0.287 | 0.990 | 0.533 |

Oversampling 35-65%:

Le tableau suivant décrit les différents systèmes Ant utilisés et met en évidence le nombre de classes, nombre de classes fautives ainsi que le ratio des classes fautives avant et après Oversampling.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Système*** | ***#Classes*** | ***#Fautives*** | ***%Fautives*** | ***#ClassesB*** | ***#FautivesB*** | ***%FautivesB*** |
| Ant13 | 126 | 60 | 47.62% | - | - | - |
| Ant14 | 178 | 38 | 21.35% | 216 | 76 | 35.18% |
| Ant15 | 293 | 106 | 36.62% | - | - | - |
| Ant16 | 352 | 45 | 12.78% | 473 | 166 | 35.09% |
| Ant17 | 675 | 70 | 10.37% | 1039 | 364 | 35.05% |

***Modèle d (LOC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | - | - | - | - | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | - | - | - | - | 0.836 | 0.919 | 0.667 | 0.783 |
| Régression Logistique | - | - | - | - | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | - | - | - | - | 0.687 | 1.000 | 0.045 | 0.212 |
| ANN | - | - | - | - | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.722 | 0.342 | 0.929 | 0.564 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.593 | 0.566 | 0.814 | 0.679 | 0.737 | 0.400 | 0.857 | 0.585 |
| Random Forest | 0.667 | 0.526 | 0.743 | *0.625* | 0.763 | 0.560 | 0.836 | **0.684** |
| Régression Logistique | 0.713 | 0.368 | 0.9 | 0.576 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.694 | 0.184 | 0.971 | 0.423 | 0.768 | 0.200 | 0.971 | 0.441 |
| ANN | 0.721 | 0.491 | 0.846 | **0.65** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.697 | 0.464 | 0.920 | 0.653 |
| J48 | - | - | - | - | 0.768 | 0.765 | 0.770 | 0.767 |
| Random Forest | - | - | - | - | 0.768 | 0.799 | 0.738 | **0.768** |
| Régression Logistique | - | - | - | - | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | - | - | - | - | 0.683 | 0.436 | 0.920 | 0.633 |
| ANN | - | - | - | - | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.704 | 0.289 | 0.928 | 0.518 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.61 | 0.608 | 0.792 | **0.694** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.666 | 0.554 | 0.726 | *0.634* | 0.821 | 0.557 | 0.873 | **0.697** |
| Régression Logistique | 0.704 | 0.307 | 0.919 | 0.531 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.662 | 0.102 | 0.964 | 0.314 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.724 | 0.455 | 0.869 | 0.63 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.731 | 0.36 | 0.93 | 0.579 | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.629 | 0.599 | 0.836 | **0.707** | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.702 | 0.563 | 0.776 | 0.661 | 0.852 | 0.465 | 0.910 | **0.650** |
| Régression Logistique | 0.744 | 0.42 | 0.919 | 0.621 | 0.889 | 0.248 | 0.985 | 0.494 |
| SVM | 0.729 | 0.343 | 0.936 | 0.567 | 0.876 | 0.089 | 0.994 | 0.297 |
| ANN | 0.757 | 0.592 | 0.847 | 0.714 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, Cbo) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.791 | 0.807 | 0.758 | 0.782 |
| J48 | - | - | - | - | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | - | - | - | - | 0.841 | 0.919 | 0.682 | 0.792 |
| Régression Logistique | - | - | - | - | 0.821 | 0.837 | 0.788 | **0.812** |
| SVM | - | - | - | - | 0.687 | 1.000 | 0.045 | 0.212 |
| ANN | - | - | - | - | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.713 | 0.316 | 0.929 | 0.542 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.583 | 0.553 | 0.814 | 0.671 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.634 | 0.526 | 0.693 | *0.604* | 0.742 | 0.560 | 0.807 | **0.672** |
| Régression Logistique | 0.708 | 0.355 | 0.9 | 0.565 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.699 | 0.197 | 0.971 | 0.438 | 0.768 | 0.200 | 0.971 | 0.441 |
| ANN | 0.719 | 0.481 | 0.849 | **0.643** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.697 | 0.464 | 0.920 | 0.653 |
| J48 | - | - | - | - | 0.768 | 0.765 | 0.770 | **0.767** |
| Random Forest | - | - | - | - | 0.765 | 0.804 | 0.727 | 0.765 |
| Régression Logistique | - | - | - | - | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | - | - | - | - | 0.686 | 0.441 | 0.920 | 0.637 |
| ANN | - | - | - | - | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.698 | 0.271 | 0.928 | 0.502 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.579 | 0.56 | 0.798 | **0.669** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.653 | 0.524 | 0.723 | *0.616* | 0.823 | 0.557 | 0.876 | **0.699** |
| Régression Logistique | 0.704 | 0.307 | 0.919 | 0.531 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.655 | 0.078 | 0.967 | 0.275 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.721 | 0.45 | 0.867 | 0.626 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.731 | 0.36 | 0.93 | *0.579* | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.608 | 0.569 | 0.837 | 0.69 | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.674 | 0.536 | 0.748 | 0.633 | 0.856 | 0.535 | 0.904 | **0.695** |
| Régression Logistique | 0.744 | 0.42 | 0.919 | 0.621 | 0.889 | 0.248 | 0.985 | 0.494 |
| SVM | 0.725 | 0.332 | 0.936 | 0.558 | 0.875 | 0.089 | 0.993 | 0.297 |
| ANN | 0.76 | 0.604 | 0.845 | **0.721** | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | - | - | - | - | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | - | - | - | - | 0.826 | 0.919 | 0.636 | 0.765 |
| Régression Logistique | - | - | - | - | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | - | - | - | - | 0.692 | 1.000 | 0.061 | 0.247 |
| ANN | - | - | - | - | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.713 | 0.329 | 0.921 | 0.551 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.612 | 0.592 | 0.814 | 0.694 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.718 | 0.605 | 0.779 | *0.686* | 0.753 | 0.580 | 0.814 | **0.687** |
| Régression Logistique | 0.713 | 0.368 | 0.9 | 0.576 | 0.779 | 0.260 | 0.964 | 0.501 |
| SVM | 0.699 | 0.197 | 0.971 | 0.438 | 0.763 | 0.180 | 0.971 | 0.418 |
| ANN | 0.719 | 0.487 | 0.846 | **0.643** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.697 | 0.469 | 0.914 | 0.655 |
| J48 | - | - | - | - | 0.770 | 0.771 | 0.770 | **0.770** |
| Random Forest | - | - | - | - | 0.757 | 0.799 | 0.717 | 0.757 |
| Régression Logistique | - | - | - | - | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | - | - | - | - | 0.678 | 0.419 | 0.925 | 0.623 |
| ANN | - | - | - | - | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.706 | 0.295 | 0.928 | 0.523 | 0.826 | 0.131 | 0.964 | 0.355 |
| J48 | 0.611 | 0.639 | 0.756 | **0.695** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.664 | 0.524 | 0.739 | *0.623* | 0.829 | 0.541 | 0.886 | **0.692** |
| Régression Logistique | 0.704 | 0.307 | 0.919 | 0.531 | 0.832 | 0.098 | 0.977 | 0.309 |
| SVM | 0.662 | 0.078 | 0.977 | 0.277 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.726 | 0.459 | 0.869 | 0.635 | 0.826 | 0.049 | 0.980 | 0.219 |
| ANT 17 | Naïve Bayes | 0.731 | 0.36 | 0.93 | 0.579 | 0.888 | 0.356 | 0.967 | 0.587 |
| J48 | 0.608 | 0.569 | 0.837 | **0.69** | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.674 | 0.536 | 0.748 | 0.633 | 0.856 | 0.505 | 0.908 | **0.677** |
| Régression Logistique | 0.744 | 0.42 | 0.919 | 0.621 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.725 | 0.332 | 0.936 | 0.558 | 0.875 | 0.069 | 0.996 | 0.262 |
| ANN | 0.76 | 0.604 | 0.845 | 0.721 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (LOC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.796 | 0.741 | 0.909 | **0.821** |
| J48 | - | - | - | - | 0.811 | 0.852 | 0.727 | 0.787 |
| Random Forest | - | - | - | - | 0.841 | 0.919 | 0.682 | 0.792 |
| Régression Logistique | - | - | - | - | 0.821 | 0.837 | 0.788 | 0.812 |
| SVM | - | - | - | - | 0.692 | 0.993 | 0.076 | 0.275 |
| ANN | - | - | - | - | 0.826 | 0.881 | 0.712 | 0.792 |
| **ANT 14** | Naïve Bayes | 0.718 | 0.329 | 0.929 | 0.553 | 0.784 | 0.340 | 0.943 | 0.566 |
| J48 | 0.589 | 0.566 | 0.807 | 0.676 | 0.753 | 0.480 | 0.850 | 0.639 |
| Random Forest | 0.634 | 0.513 | 0.7 | *0.599* | 0.753 | 0.560 | 0.821 | **0.678** |
| Régression Logistique | 0.708 | 0.355 | 0.9 | 0.565 | 0.774 | 0.260 | 0.957 | 0.499 |
| SVM | 0.699 | 0.197 | 0.971 | 0.438 | 0.774 | 0.220 | 0.971 | 0.462 |
| ANN | 0.715 | 0.472 | 0.847 | **0.635** | 0.768 | 0.440 | 0.886 | 0.624 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.694 | 0.464 | 0.914 | 0.651 |
| J48 | - | - | - | - | 0.768 | 0.765 | 0.770 | **0.767** |
| Random Forest | - | - | - | - | 0.762 | 0.810 | 0.717 | 0.762 |
| Régression Logistique | - | - | - | - | 0.740 | 0.615 | 0.861 | 0.728 |
| SVM | - | - | - | - | 0.686 | 0.441 | 0.920 | 0.637 |
| ANN | - | - | - | - | 0.765 | 0.754 | 0.775 | 0.764 |
| ANT 16 | Naïve Bayes | 0.7 | 0.277 | 0.928 | 0.507 | 0.823 | 0.131 | 0.961 | 0.355 |
| J48 | 0.631 | 0.669 | 0.756 | **0.711** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.672 | 0.566 | 0.73 | *0.643* | 0.829 | 0.557 | 0.883 | **0.701** |
| Régression Logistique | 0.704 | 0.307 | 0.919 | 0.531 | 0.834 | 0.115 | 0.977 | 0.335 |
| SVM | 0.664 | 0.108 | 0.964 | 0.323 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.719 | 0.447 | 0.866 | 0.624 | 0.823 | 0.049 | 0.977 | 0.219 |
| ANT 17 | Naïve Bayes | 0.727 | 0.349 | 0.93 | 0.57 | 0.887 | 0.366 | 0.964 | 0.594 |
| J48 | 0.673 | 0.673 | 0.824 | **0.745** | 0.896 | 0.248 | 0.993 | 0.496 |
| Random Forest | 0.71 | 0.585 | 0.778 | 0.675 | 0.862 | 0.545 | 0.910 | **0.704** |
| Régression Logistique | 0.746 | 0.426 | 0.919 | 0.625 | 0.890 | 0.248 | 0.987 | 0.495 |
| SVM | 0.723 | 0.319 | 0.941 | 0.548 | 0.875 | 0.079 | 0.994 | 0.280 |
| ANN | 0.761 | 0.598 | 0.849 | 0.721 | 0.889 | 0.347 | 0.970 | 0.580 |

***Modèle d (Qi, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.642 | 0.933 | 0.045 | 0.205 |
| J48 | - | - | - | - | 0.801 | 0.919 | 0.561 | **0.718** |
| Random Forest | - | - | - | - | 0.776 | 0.874 | 0.576 | 0.710 |
| Régression Logistique | - | - | - | - | 0.682 | 0.993 | 0.045 | 0.211 |
| SVM | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | - | - | - | - | 0.761 | 0.911 | 0.455 | 0.644 |
| **ANT 14** | Naïve Bayes | 0.644 | 0.039 | 0.971 | 0.196 | 0.732 | 0.060 | 0.971 | 0.241 |
| J48 | 0.647 | 0.737 | 0.707 | 0.722 | 0.747 | 0.420 | 0.864 | 0.602 |
| Random Forest | 0.704 | 0.461 | 0.836 | **0.62** | 0.774 | 0.560 | 0.850 | **0.690** |
| Régression Logistique | 0.657 | 0.092 | 0.964 | 0.298 | 0.732 | 0.060 | 0.971 | 0.241 |
| SVM | 0.644 | 0.013 | 0.986 | 0.114 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.718 | 0.445 | 0.866 | 0.677 | 0.800 | 0.500 | 0.907 | 0.673 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.552 | 0.128 | 0.957 | 0.350 |
| J48 | - | - | - | - | 0.735 | 0.654 | 0.813 | 0.729 |
| Random Forest | - | - | - | - | 0.732 | 0.665 | 0.797 | 0.728 |
| Régression Logistique | - | - | - | - | 0.697 | 0.525 | 0.861 | 0.672 |
| SVM | - | - | - | - | 0.530 | 0.050 | 0.989 | 0.222 |
| ANN | - | - | - | - | 0.746 | 0.687 | 0.802 | **0.742** |
| ANT 16 | Naïve Bayes | 0.641 | 0.012 | 0.98 | 0.109 | 0.821 | 0.000 | 0.984 | 0.000 |
| J48 | 0.503 | 0.434 | 0.844 | 0.605 | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.803 | 0.59 | 0.919 | **0.736** | 0.851 | 0.443 | 0.932 | **0.643** |
| Régression Logistique | 0.645 | 0.012 | 0.987 | 0.109 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.649 | 0 | 1 | 0 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.645 | 0.04 | 0.972 | 0.364 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANT 17 | Naïve Bayes | 0.658 | 0.058 | 0.982 | *0.238* | 0.870 | 0.079 | 0.988 | 0.279 |
| J48 | 0.57 | 0.511 | 0.847 | 0.658 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.865 | 0.717 | 0.945 | **0.823** | 0.885 | 0.376 | 0.961 | **0.601** |
| Régression Logistique | 0.674 | 0.135 | 0.964 | 0.36 | 0.872 | 0.050 | 0.996 | 0.223 |
| SVM | 0.65 | 0.003 | 0.999 | 0.052 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN | 0.696 | 0.296 | 0.912 | 0.593 | 0.860 | 0.050 | 0.981 | 0.221 |

***Modèle d (Qi, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.612 | 0.881 | 0.061 | 0.232 |
| J48 | - | - | - | - | 0.756 | 0.919 | 0.424 | 0.624 |
| Random Forest | - | - | - | - | 0.806 | 0.867 | 0.682 | **0.769** |
| Régression Logistique | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| SVM | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| **ANT 14** | Naïve Bayes | 0.657 | 0.053 | 0.986 | 0.228 | 0.726 | 0.020 | 0.979 | 0.140 |
| J48 | 0.657 | 0.618 | 0.857 | 0.728 | 0.826 | 0.640 | 0.893 | **0.756** |
| Random Forest | 0.819 | 0.684 | 0.893 | **0.782** | 0.795 | 0.580 | 0.871 | 0.711 |
| Régression Logistique | 0.667 | 0.079 | 0.986 | 0.279 | 0.732 | 0.040 | 0.979 | 0.198 |
| SVM | 0.644 | 0.013 | 0.986 | 0.114 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.686 | 0.259 | 0.917 | 0.674 | 0.768 | 0.380 | 0.907 | 0.587 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.555 | 0.134 | 0.957 | 0.358 |
| J48 | - | - | - | - | 0.683 | 0.765 | 0.604 | 0.680 |
| Random Forest | - | - | - | - | 0.732 | 0.715 | 0.749 | **0.732** |
| Régression Logistique | - | - | - | - | 0.571 | 0.179 | 0.947 | 0.412 |
| SVM | - | - | - | - | 0.522 | 0.034 | 0.989 | 0.183 |
| ANN | - | - | - | - | 0.626 | 0.419 | 0.824 | 0.588 |
| ANT 16 | Naïve Bayes | 0.641 | 0 | 0.987 | 0 | 0.826 | 0.000 | 0.990 | 0.000 |
| J48 | 0.377 | 0.277 | 0.896 | 0.498 | 0.829 | 0.000 | 0.993 | 0.000 |
| Random Forest | 0.805 | 0.584 | 0.925 | **0.735** | 0.845 | 0.377 | 0.938 | **0.595** |
| Régression Logistique | 0.647 | 0.012 | 0.99 | 0.109 | 0.829 | 0.000 | 0.993 | 0.000 |
| SVM | 0.649 | 0 | 1 | 0 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.649 | 0.009 | 0.995 | 0.131 | 0.823 | 0.000 | 0.987 | 0.000 |
| ANT 17 | Naïve Bayes | 0.648 | 0.003 | 0.996 | *0.052* | 0.870 | 0.069 | 0.990 | 0.261 |
| J48 | 0.493 | 0.327 | 1 | 0.572 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.835 | 0.648 | 0.936 | **0.779** | 0.865 | 0.168 | 0.969 | **0.403** |
| Régression Logistique | 0.645 | 0 | 0.993 | 0 | 0.866 | 0.000 | 0.996 | 0.000 |
| SVM | 0.65 | 0 | 1 | 0 | 0.870 | 0.000 | 1.000 | 0.000 |
| ANN | 0.647 | 0.001 | 0.995 | 0.074 | 0.870 | 0.030 | 0.996 | 0.173 |

***Modèle d (WMC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.657 | 0.941 | 0.076 | 0.267 |
| J48 | - | - | - | - | 0.677 | 0.807 | 0.409 | 0.575 |
| Random Forest | - | - | - | - | 0.711 | 0.822 | 0.485 | **0.631** |
| Régression Logistique | - | - | - | - | 0.667 | 0.985 | 0.015 | 0.122 |
| SVM | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | - | - | - | - | 0.692 | 0.919 | 0.227 | 0.457 |
| **ANT 14** | Naïve Bayes | 0.657 | 0.105 | 0.957 | 0.317 | 0.742 | 0.120 | 0.964 | 0.340 |
| J48 | 0.575 | 0.605 | 0.729 | **0.664** | 0.716 | 0.140 | 0.921 | 0.359 |
| Random Forest | 0.694 | 0.513 | 0.793 | *0.638* | 0.784 | 0.520 | 0.879 | **0.676** |
| Régression Logistique | 0.667 | 0.132 | 0.957 | 0.355 | 0.737 | 0.080 | 0.971 | 0.279 |
| SVM | 0.644 | 0.013 | 0.986 | 0.114 | 0.732 | 0.000 | 0.993 | 0.000 |
| ANN | 0.694 | 0.37 | 0.87 | 0.631 | 0.784 | 0.420 | 0.914 | 0.620 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.552 | 0.123 | 0.963 | 0.344 |
| J48 | - | - | - | - | 0.702 | 0.642 | 0.759 | **0.698** |
| Random Forest | - | - | - | - | 0.675 | 0.687 | 0.663 | 0.675 |
| Régression Logistique | - | - | - | - | 0.617 | 0.385 | 0.840 | 0.569 |
| SVM | - | - | - | - | 0.525 | 0.039 | 0.989 | 0.196 |
| ANN | - | - | - | - | 0.678 | 0.564 | 0.786 | 0.666 |
| ANT 16 | Naïve Bayes | 0.649 | 0.054 | 0.971 | 0.229 | 0.815 | 0.000 | 0.977 | 0.000 |
| J48 | 0.274 | 0.187 | 0.906 | 0.411 | 0.823 | 0.033 | 0.980 | 0.180 |
| Random Forest | 0.685 | 0.44 | 0.818 | **0.6** | 0.815 | 0.344 | 0.909 | **0.559** |
| Régression Logistique | 0.649 | 0.024 | 0.987 | 0.154 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.649 | 0 | 1 | 0 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.645 | 0.025 | 0.98 | 0.252 | 0.826 | 0.000 | 0.990 | 0.000 |
| ANT 17 | Naïve Bayes | 0.654 | 0.049 | 0.981 | 0.22 | 0.866 | 0.079 | 0.984 | 0.279 |
| J48 | 0.463 | 0.448 | 0.738 | 0.575 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.736 | 0.505 | 0.861 | **0.66** | 0.880 | 0.426 | 0.948 | **0.635** |
| Régression Logistique | 0.649 | 0.025 | 0.985 | 0.156 | 0.872 | 0.040 | 0.997 | 0.200 |
| SVM | 0.649 | 0 | 0.999 | 0 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN | 0.653 | 0.054 | 0.977 | 0.372 | 0.867 | 0.020 | 0.994 | 0.141 |

***Modèle d (WMC, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.652 | 0.933 | 0.076 | 0.266 |
| J48 | - | - | - | - | 0.756 | 0.889 | 0.485 | 0.657 |
| Random Forest | - | - | - | - | 0.786 | 0.896 | 0.561 | **0.709** |
| Régression Logistique | - | - | - | - | 0.741 | 0.948 | 0.318 | 0.549 |
| SVM | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | - | - | - | - | 0.781 | 0.919 | 0.500 | 0.678 |
| **ANT 14** | Naïve Bayes | 0.694 | 0.224 | 0.95 | 0.461 | 0.758 | 0.200 | 0.957 | 0.437 |
| J48 | 0.614 | 0.671 | 0.721 | 0.696 | 0.768 | 0.400 | 0.900 | 0.600 |
| Random Forest | 0.685 | 0.487 | 0.793 | *0.621* | 0.784 | 0.600 | 0.850 | **0.714** |
| Régression Logistique | 0.731 | 0.342 | 0.943 | 0.568 | 0.753 | 0.200 | 0.950 | 0.436 |
| SVM | 0.644 | 0.013 | 0.986 | 0.114 | 0.726 | 0.000 | 0.986 | 0.000 |
| ANN | 0.737 | 0.516 | 0.856 | **0.669** | 0.784 | 0.480 | 0.893 | 0.655 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.604 | 0.223 | 0.968 | 0.465 |
| J48 | - | - | - | - | 0.724 | 0.715 | 0.733 | 0.724 |
| Random Forest | - | - | - | - | 0.724 | 0.726 | 0.722 | **0.724** |
| Régression Logistique | - | - | - | - | 0.730 | 0.615 | 0.840 | 0.719 |
| SVM | - | - | - | - | 0.587 | 0.190 | 0.968 | 0.429 |
| ANN | - | - | - | - | 0.727 | 0.665 | 0.786 | 0.723 |
| ANT 16 | Naïve Bayes | 0.651 | 0.084 | 0.958 | 0.284 | 0.815 | 0.016 | 0.974 | 0.125 |
| J48 | 0.521 | 0.452 | 0.847 | 0.619 | 0.834 | 0.997 | 0.016 | 0.126 |
| Random Forest | 0.723 | 0.56 | 0.811 | **0.674** | 0.837 | 0.475 | 0.909 | **0.657** |
| Régression Logistique | 0.653 | 0.084 | 0.961 | 0.285 | 0.829 | 0.016 | 0.990 | 0.126 |
| SVM | 0.645 | 0 | 0.993 | 0 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.679 | 0.24 | 0.916 | 0.492 | 0.818 | 0.000 | 0.980 | 0.000 |
| ANT 17 | Naïve Bayes | 0.679 | 0.124 | 0.978 | *0.348* | 0.869 | 0.079 | 0.987 | 0.279 |
| J48 | 0.564 | 0.522 | 0.822 | 0.655 | 0.865 | 0.168 | 0.969 | 0.403 |
| Random Forest | 0.705 | 0.519 | 0.804 | **0.646** | 0.883 | 0.535 | 0.935 | **0.707** |
| Régression Logistique | 0.692 | 0.209 | 0.953 | 0.446 | 0.875 | 0.079 | 0.994 | 0.280 |
| SVM | 0.653 | 0.016 | 0.996 | 0.128 | 0.869 | 0.000 | 0.999 | 0.000 |
| ANN | 0.715 | 0.468 | 0.849 | 0.637 | 0.865 | 0.089 | 0.981 | 0.295 |

***Modèle d (WMC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.697 | 0.630 | 0.833 | 0.724 |
| J48 | - | - | - | - | 0.766 | 0.830 | 0.636 | 0.727 |
| Random Forest | - | - | - | - | 0.826 | 0.919 | 0.636 | **0.765** |
| Régression Logistique | - | - | - | - | 0.781 | 0.837 | 0.667 | 0.747 |
| SVM | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | - | - | - | - | 0.771 | 0.896 | 0.515 | 0.679 |
| **ANT 14** | Naïve Bayes | 0.722 | 0.342 | 0.929 | 0.564 | 0.800 | 0.360 | 0.957 | 0.587 |
| J48 | 0.469 | 0.395 | 0.843 | **0.577** | 0.789 | 0.400 | 0.929 | 0.610 |
| Random Forest | 0.653 | 0.408 | 0.786 | *0.566* | 0.753 | 0.560 | 0.821 | **0.678** |
| Régression Logistique | 0.718 | 0.421 | 0.879 | 0.608 | 0.800 | 0.360 | 0.957 | 0.587 |
| SVM | 0.676 | 0.092 | 0.993 | 0.302 | 0.753 | 0.060 | 1.000 | 0.245 |
| ANN | 0.729 | 0.499 | 0.854 | 0.655 | 0.789 | 0.400 | 0.929 | 0.610 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.705 | 0.497 | 0.904 | 0.670 |
| J48 | - | - | - | - | 0.773 | 0.726 | 0.818 | **0.771** |
| Random Forest | - | - | - | - | 0.770 | 0.737 | 0.802 | 0.769 |
| Régression Logistique | - | - | - | - | 0.760 | 0.642 | 0.872 | 0.748 |
| SVM | - | - | - | - | 0.730 | 0.547 | 0.904 | 0.703 |
| ANN | - | - | - | - | 0.770 | 0.732 | 0.**807** | 0.769 |
| ANT 16 | Naïve Bayes | 0.681 | 0.259 | 0.909 | 0.485 | 0.834 | 0.197 | 0.961 | 0.435 |
| J48 | 0.561 | 0.512 | 0.831 | **0.652** | 0.834 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.729 | 0.536 | 0.834 | 0.669 | 0.823 | 0.393 | 0.909 | **0.598** |
| Régression Logistique | 0.679 | 0.259 | 0.906 | 0.484 | 0.829 | 0.082 | 0.977 | 0.283 |
| SVM | 0.653 | 0.042 | 0.984 | 0.204 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.692 | 0.364 | 0.87 | 0.582 | 0.829 | 0.000 | 0.993 | 0.000 |
| ANT 17 | Naïve Bayes | 0.714 | 0.335 | 0.919 | *0.555* | 0.876 | 0.327 | 0.959 | 0.560 |
| J48 | 0.6 | 0.558 | 0.837 | 0.683 | 0.901 | 0.317 | 0.988 | 0.560 |
| Random Forest | 0.772 | 0.602 | 0.864 | **0.721** | 0.876 | 0.455 | 0.939 | **0.654** |
| Régression Logistique | 0.719 | 0.39 | 0.896 | 0.591 | 0.901 | 0.317 | 0.988 | 0.560 |
| SVM | 0.708 | 0.261 | 0.95 | 0.498 | 0.871 | 0.010 | 1.000 | 0.100 |
| ANN | 0.73 | 0.471 | 0.869 | 0.671 | 0.894 | 0.287 | 0.985 | 0.532 |

***Modèle d (WMC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACCB** | **TPRB** | **TNRB** | **g-meanB** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes | - | - | - | - | 0.637 | 0.911 | 0.076 | 0.263 |
| J48 | - | - | - | - | 0.736 | 0.881 | 0.439 | 0.622 |
| Random Forest | - | - | - | - | 0.741 | 0.852 | 0.515 | **0.662** |
| Régression Logistique | - | - | - | - | 0.672 | 0.985 | 0.030 | 0.172 |
| SVM | - | - | - | - | 0.672 | 1.000 | 0.000 | 0.000 |
| ANN | - | - | - | - | 0.731 | 0.926 | 0.333 | 0.555 |
| **ANT 14** | Naïve Bayes | 0.662 | 0.079 | 0.979 | 0.278 | 0.742 | 0.080 | 0.979 | 0.280 |
| J48 | 0.654 | 0.684 | 0.779 | **0.73** | 0.779 | 0.660 | 0.821 | **0.736** |
| Random Forest | 0.69 | 0.553 | 0.764 | *0.65* | 0.805 | 0.600 | 0.879 | 0.726 |
| Régression Logistique | 0.662 | 0.092 | 0.971 | 0.299 | 0.742 | 0.080 | 0.979 | 0.280 |
| SVM | 0.662 | 0.066 | 0.986 | 0.255 | 0.726 | 0.000 | 0.986 | 0.000 |
| ANN | 0.763 | 0.596 | 0.854 | 0.722 | 0.816 | 0.580 | 0.900 | 0.722 |
| **ANT 15** | Naïve Bayes | - | - | - | - | 0.566 | 0.140 | 0.973 | 0.369 |
| J48 | - | - | - | - | 0.727 | 0.765 | 0.690 | **0.727** |
| Random Forest | - | - | - | - | 0.721 | 0.737 | 0.706 | 0.721 |
| Régression Logistique | - | - | - | - | 0.615 | 0.313 | 0.904 | 0.532 |
| SVM | - | - | - | - | 0.519 | 0.034 | 0.984 | 0.183 |
| ANN | - | - | - | - | 0.694 | 0.642 | 0.743 | 0.691 |
| ANT 16 | Naïve Bayes | 0.645 | 0.012 | 0.987 | 0.109 | 0.826 | 0.000 | 0.990 | 0.000 |
| J48 | 0.402 | 0.313 | 0.866 | 0.521 | 0.834 | 0.016 | 0.997 | 0.126 |
| Random Forest | 0.679 | 0.452 | 0.801 | **0.602** | 0.815 | 0.426 | 0.893 | **0.617** |
| Régression Logistique | 0.647 | 0.018 | 0.987 | 0.134 | 0.826 | 0.000 | 0.990 | 0.000 |
| SVM | 0.647 | 0 | 0.997 | 0 | 0.834 | 0.000 | 1.000 | 0.000 |
| ANN | 0.66 | 0.069 | 0.98 | 0.401 | 0.832 | 0.033 | 0.990 | 0.181 |
| ANT 17 | Naïve Bayes | 0.646 | 0 | 0.994 | *0* | 0.863 | 0.069 | 0.982 | 0.260 |
| J48 | 0.441 | 0.376 | 0.821 | 0.556 | 0.870 | 0.000 | 1.000 | 0.000 |
| Random Forest | 0.729 | 0.536 | 0.833 | **0.668** | 0.880 | 0.406 | 0.951 | **0.621** |
| Régression Logistique | 0.644 | 0.016 | 0.982 | 0.127 | 0.871 | 0.040 | 0.996 | 0.200 |
| SVM | 0.648 | 0 | 0.997 | 0 | 0.870 | 0.000 | 1.000 | 0.000 |
| ANN | 0.661 | 0.13 | 0.948 | 0.479 | 0.869 | 0.000 | 0.999 | 0.000 |

1. Existence de Faute de Sévérité élevé:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Système*** | ***#Classes*** | ***#Fautives*** | ***%Fautives*** | ***#ClassesD*** | ***#FautivesD*** | ***%FautivesD*** |
| Ant13 |  |  |  |  |  |  |
| Ant14 |  |  |  |  |  |  |
| Ant15 | 293 | 55 | 18.77% | 298 | 60 | 20.13% |
| Ant16 |  |  |  |  |  |  |
| Ant17 |  |  |  |  |  |  |

***Modèle d (LOC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.795 | 0.073 | 0.962 | 0.265 | 0.779 | 0.067 | 0.958 | 0.253 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.758 | 0.400 | 0.84 | **0.580** | 0.765 | 0.467 | 0.84 | **0.626** |
| Régression Logistique | 0.799 | 0.036 | 0.975 | 0.188 | 0.789 | 0.067 | 0.971 | 0.254 |
| SVM | 0.812 | 0.000 | 1.000 | 0.000 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.795 | 0.039 | 0.969 | 0.201 | 0.78 | 0.044 | 0.965 | 0.249 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Cbo) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.795 | 0.073 | 0.962 | 0.265 | 0.779 | 0.067 | 0.958 | 0.253 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.744 | 0.345 | 0.836 | **0.537** | 0.748 | 0.433 | 0.828 | **0.599** |
| Régression Logistique | 0.799 | 0.036 | 0.975 | 0.188 | 0.789 | 0.067 | 0.971 | 0.254 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.795 | 0.039 | 0.969 | 0.201 | 0.77 | 0.066 | 0.948 | 0.251 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.792 | 0.055 | 0.962 | 0.229 | 0.782 | 0.067 | 0.962 | 0.253 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.761 | 0.382 | 0.849 | 0.569 | 0.748 | 0.467 | 0.819 | 0.618 |
| Régression Logistique | 0.799 | 0.036 | 0.975 | 0.188 | 0.792 | 0.067 | 0.975 | 0.255 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.795 | 0.04 | 0.969 | 0.21 | 0.781 | 0.047 | 0.966 | 0.258 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.795 | 0.073 | 0.962 | 0.265 | 0.779 | 0.067 | 0.958 | 0.253 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.751 | 0.382 | 0.836 | **0.565** | 0.752 | 0.483 | 0.819 | **0.629** |
| Régression Logistique | 0.799 | 0.036 | 0.975 | 0.188 | 0.789 | 0.067 | 0.971 | 0.254 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.794 | 0.036 | 0.97 | 0.194 | 0.77 | 0.065 | 0.947 | 0.254 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.799 | 0.0 | 0.983 | 0.0 | 0.782 | 0.0 | 0.979 | 0.0 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |
| Random Forest | 0.792 | 0.255 | 0.916 | 0.483 | 0.792 | 0.367 | 0.899 | **0.574** |
| Régression Logistique | 0.809 | 0.0 | 0.996 | 0.0 | 0.795 | 0.0 | 0.996 | 0.0 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.811 | 0.0 | 0.998 | 0.0 | 0.796 | 0.0 | 0.997 | 0.0 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.809 | 0.0 | 0.996 | 0.0 | 0.792 | 0.0 | 0.992 | 0.0 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |
| Random Forest | 0.765 | 0.164 | 0.903 | 0.384 | 0.775 | 0.267 | 0.903 | 0.491 |
| Régression Logistique | 0.809 | 0.0 | 0.996 | 0.0 | 0.795 | 0.0 | 0.996 | 0.0 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.812 | 0.0 | 1.0 | 0.0 | 0.798 | 0.0 | 0.999 | 0.0 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.799 | 0.0 | 0.983 | 0.0 | 0.779 | 0.0 | 0.975 | 0.0 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |
| Random Forest | 0.73 | 0.073 | 0.882 | 0.253 | 0.715 | 0.15 | 0.857 | 0.359 |
| Régression Logistique | 0.812 | 0.0 | 1.0 | 0.0 | 0.795 | 0.0 | 0.996 | 0.0 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.812 | 0.0 | 1.0 | 0.0 | 0.798 | 0.0 | 0.999 | 0.0 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.792 | 0.018 | 0.971 | 0.133 | 0.775 | 0.017 | 0.966 | 0.127 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |
| Random Forest | 0.765 | 0.273 | 0.878 | 0.489 | 0.779 | 0.333 | 0.891 | 0.545 |
| Régression Logistique | 0.809 | 0.018 | 0.992 | 0.134 | 0.792 | 0.017 | 0.987 | 0.128 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.811 | 0.0 | 0.998 | 0.0 | 0.792 | 0.0 | 0.992 | 0.0 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.816 | 0.164 | 0.966 | 0.398 | 0.792 | 0.15 | 0.954 | 0.378 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.992 | 0.0 |
| Random Forest | 0.734 | 0.164 | 0.866 | 0.376 | 0.745 | 0.25 | 0.87 | 0.466 |
| Régression Logistique | 0.812 | 0.055 | 0.987 | 0.232 | 0.795 | 0.067 | 0.979 | 0.255 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.807 | 0.025 | 0.988 | 0.172 | 0.778 | 0.044 | 0.963 | 0.222 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.802 | 0.0 | 0.987 | 0.0 | 0.785 | 0.0 | 0.983 | 0.0 |
| J48 | 0.0 | 0.0 | 0.996 | 0.0 | 0.0 | 0.0 | 1.0 | 0.0 |
| Random Forest | 0.751 | 0.164 | 0.887 | 0.381 | 0.748 | 0.25 | 0.874 | 0.467 |
| Régression Logistique | 0.809 | 0.0 | 0.996 | 0.0 | 0.792 | 0.0 | 0.992 | 0.0 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.811 | 0.0 | 0.998 | 0.0 | 0.795 | 0.0 | 0.996 | 0.0 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (RFC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.805 | 0.182 | 0.95 | 0.416 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.088 | 0.055 | 0.958 | 0.229 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.795 | 0.4 | 0.887 | **0.596** | 0.758 | 0.467 | 0.832 | **0.623** |
| Régression Logistique | 0.792 | 0.036 | 0.966 | 0.187 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.788 | 0.016 | 0.967 | 0.133 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, RFC) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.792 | 0.091 | 0.954 | 0.294 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.761 | 0.382 | 0.849 | 0.569 | 0.758 | 0.467 | 0.832 | 0.623 |
| Régression Logistique | 0.795 | 0.055 | 0.966 | 0.23 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.803 | 0.015 | 0.985 | 0.13 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

1. Existence de Faute de Sévérité  Normale:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Système*** | ***#Classes*** | ***#Fautives*** | ***%Fautives*** | ***#ClassesD*** | ***#FautivesD*** | ***%FautivesD*** |
| Ant13 |  |  |  |  |  |  |
| Ant14 |  |  |  |  |  |  |
| Ant15 | 293 | 58 | 19.79% | 316 | 81 | 25.63% |
| Ant16 |  |  |  |  |  |  |
| Ant17 |  |  |  |  |  |  |

***Modèle d (LOC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.802 | 0.155 | 0.962 | 0.386 | 0.772 | 0.235 | 0.957 | 0.474 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.593 | 0.667 | 0.8 | **0.730** |
| Random Forest | 0.771 | 0.362 | 0.872 | **0.562** | 0.797 | 0.593 | 0.868 | 0.717 |
| Régression Logistique | 0.809 | 0.138 | 0.974 | 0.367 | 0.778 | 0.259 | 0.957 | 0.498 |
| SVM | 0.802 | 0.0 | 1.0 | 0.0 | 0.766 | 0.136 | 0.983 | 0.365 |
| ANN | 0.797 | 0.261 | 0.929 | 0.546 | 0.775 | 0.382 | 0.911 | 0.702 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Cbo) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.802 | 0.155 | 0.962 | 0.386 | 0.772 | 0.235 | 0.957 | 0.474 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.593 | 0.667 | 0.8 | **0.730** |
| Random Forest | 0.761 | 0.379 | 0.855 | **0.570** | 0.788 | 0.605 | 0.851 | 0.718 |
| Régression Logistique | 0.809 | 0.138 | 0.974 | 0.367 | 0.775 | 0.259 | 0.953 | 0.497 |
| SVM | 0.802 | 0.0 | 1.0 | 0.0 | 0.766 | 0.123 | 0.987 | 0.349 |
| ANN | 0.797 | 0.261 | 0.929 | 0.546 | 0.775 | 0.381 | 0.911 | 0.701 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.802 | 0.155 | 0.962 | 0.386 | 0.772 | 0.235 | 0.957 | 0.474 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.649 | 0.753 | 0.804 | **0.778** |
| Random Forest | 0.747 | 0.345 | 0.847 | 0.54 | 0.778 | 0.568 | 0.851 | 0.695 |
| Régression Logistique | 0.805 | 0.121 | 0.974 | 0.343 | 0.775 | 0.247 | 0.957 | 0.486 |
| SVM | 0.802 | 0.0 | 1.0 | 0.0 | 0.759 | 0.111 | 0.983 | 0.330 |
| ANN | 0.796 | 0.25 | 0.93 | 0.547 | 0.775 | 0.378 | 0.911 | 0.698 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.802 | 0.155 | 0.962 | 0.386 | 0.772 | 0.235 | 0.957 | 0.474 |
| J48 | 0.0 | 0.0 | 1.0 | 0.0 | 0.593 | 0.667 | 0.8 | **0.730** |
| Random Forest | 0.758 | 0.362 | 0.855 | **0.556** | 0.791 | 0.605 | 0.855 | 0.719 |
| Régression Logistique | 0.809 | 0.138 | 0.974 | 0.367 | 0.775 | 0.259 | 0.953 | 0.497 |
| SVM | 0.802 | 0.0 | 1.0 | 0.0 | 0.766 | 0.136 | 0.983 | 0.365 |
| ANN | 0.798 | 0.268 | 0.929 | 0.546 | 0.776 | 0.385 | 0.911 | 0.704 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.0 | 0.0 | 1.0 | 0.0 | 0.744 | 0.062 | 0.979 | 0.246 |
| J48 | 0.754 | 0.293 | 0.868 | **0.504** | 0.554 | 0.63 | 0.779 | 0.7 |
| Random Forest | 0.802 | 0.034 | 0.991 | 0.185 | 0.801 | 0.593 | 0.872 | **0.719** |
| Régression Logistique | 0.802 | 0.0 | 1.0 | 0.0 | 0.744 | 0.062 | 0.979 | 0.246 |
| SVM | 0.794 | 0.046 | 0.979 | 0.316 | 0.737 | 0.0 | 0.991 | 0.0 |
| ANN | 0.0 | 0.0 | 1.0 | 0.0 | 0.75 | 0.272 | 0.914 | 0.548 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (RFC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.805 | 0.182 | 0.95 | 0.416 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.088 | 0.055 | 0.958 | 0.229 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.795 | 0.4 | 0.887 | **0.596** | 0.758 | 0.467 | 0.832 | **0.623** |
| Régression Logistique | 0.792 | 0.036 | 0.966 | 0.187 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.788 | 0.016 | 0.967 | 0.133 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, RFC) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.792 | 0.091 | 0.954 | 0.294 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.761 | 0.382 | 0.849 | 0.569 | 0.758 | 0.467 | 0.832 | 0.623 |
| Régression Logistique | 0.795 | 0.055 | 0.966 | 0.23 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.803 | 0.015 | 0.985 | 0.13 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

1. Existence de Faute de Sévérité Faible :

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| ***Système*** | ***#Classes*** | ***#Fautives*** | ***%Fautives*** | ***#ClassesD*** | ***#FautivesD*** | ***%FautivesD*** |
| Ant13 |  |  |  |  |  |  |
| Ant14 |  |  |  |  |  |  |
| Ant15 | 293 | 18 | 6.14% | 295 | 20 | 6.78% |
| Ant16 |  |  |  |  |  |  |
| Ant17 |  |  |  |  |  |  |

***Modèle d (LOC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Cbo) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (RFC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.805 | 0.182 | 0.95 | 0.416 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.088 | 0.055 | 0.958 | 0.229 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.795 | 0.4 | 0.887 | **0.596** | 0.758 | 0.467 | 0.832 | **0.623** |
| Régression Logistique | 0.792 | 0.036 | 0.966 | 0.187 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.788 | 0.016 | 0.967 | 0.133 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, RFC) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.792 | 0.091 | 0.954 | 0.294 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.761 | 0.382 | 0.849 | 0.569 | 0.758 | 0.467 | 0.832 | 0.623 |
| Régression Logistique | 0.795 | 0.055 | 0.966 | 0.23 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.803 | 0.015 | 0.985 | 0.13 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

1. Sévérité des Fautes :

L’idée est de crées une nouvelle classe qui décrit la sévérité des fautes tel quesi cette classe vaut :

* 0 alors la classe ne contient pas de faute.
* 1 contient des fautes de sévérité faible.
* 2 contient des fautes de sévérité normale.
* 3 contient des fautes de sévérité élevé.

En prenant en compte les classes de sévérité les plus élevés : faible, moyenne, et élevé. Exemple

Si une classe contient 3 fautes de sévérité faible, une de sévérité élevée elle sera considérée de sévérité 3.

***Modèle d (LOC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Cbo) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (Qi, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, CBO) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, Ce) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (WMC, FANIN) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (RFC, Ca) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.805 | 0.182 | 0.95 | 0.416 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.088 | 0.055 | 0.958 | 0.229 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.795 | 0.4 | 0.887 | **0.596** | 0.758 | 0.467 | 0.832 | **0.623** |
| Régression Logistique | 0.792 | 0.036 | 0.966 | 0.187 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.788 | 0.016 | 0.967 | 0.133 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

***Modèle d (LOC, RFC) :***

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | | **ACC** | **TPR** | **TNR** | **g-mean** | **ACCD** | **TPRD** | **TNRD** | **g-meanD** |
| **ANT 13** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 14** | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| **ANT 15** | Naïve Bayes | 0.792 | 0.091 | 0.954 | 0.294 | 0.772 | 0.1 | 0.941 | 0.307 |
| J48 | 0.033 | 0.018 | 0.983 | 0.134 | 0.358 | 0.317 | 0.887 | 0.53 |
| Random Forest | 0.761 | 0.382 | 0.849 | 0.569 | 0.758 | 0.467 | 0.832 | 0.623 |
| Régression Logistique | 0.795 | 0.055 | 0.966 | 0.23 | 0.782 | 0.067 | 0.962 | 0.253 |
| SVM | 0.812 | 0.0 | 1.0 | 0.0 | 0.799 | 0.0 | 1.0 | 0.0 |
| ANN | 0.803 | 0.015 | 0.985 | 0.13 | 0.773 | 0.038 | 0.959 | 0.234 |
| ANT 16 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |
| ANT 17 | Naïve Bayes |  |  |  |  |  |  |  |  |
| J48 |  |  |  |  |  |  |  |  |
| Random Forest |  |  |  |  |  |  |  |  |
| Régression Logistique |  |  |  |  |  |  |  |  |
| SVM |  |  |  |  |  |  |  |  |
| ANN |  |  |  |  |  |  |  |  |

Discussion