MARIO-RUBY

Single Classifier

For the single classifier, the classifier must be able to identify the tweets into the three categories (CA, CD, and D).

Table 1 shows the summary of results for this experiment. The Random Forest Algorithm got the highest score, while J48 got the lowest score. The Random Forest works best for this experiment because of the large number of attributes present in the dataset.

Table 1. Summary of Single Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.843 | 0.842 | 0.837 | 0.7175 |
| kNN-5 | 0.819 | 0.816 | 0.808 | 0.6688 |
| kNN-7 | 0.792 | .0788 | 0.778 | 0.6148 |
| Random Forest | 0.876 | 0.875 | 0.87 | 0.7764 |
| J48 | 0.787 | 0.755 | 0.738 | 0.5512 |

Multiple Binary Classifier

For the multiple binary classifier, each classifier will only classify two categories, either it is classified to the classifier’s assigned category or it is not. If it is classified as not belonging to the category, it will cascade onto the next binary classifier until a category is chosen. If the tweet is not categorized at all, only then will it be classified as Others (O).

Table 2 lists the results for the CA binary classifier. We see that there is not much of a significant difference in the precision, recall, and f-measure of all the classifiers. The Random Forest algorithm performed the best by basing it on the all the measures.

Table 2. (CA) Binary Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.881 | 0.877 | 0.877 | 0.7547 |
| kNN-5 | 0.86 | 0.858 | 0.858 | 0.7158 |
| kNN-7 | 0.813 | 0.813 | 0.813 | 0.625 |
| Random Forest | 0.906 | 0.903 | 0.903 | 0.8058 |
| J48 | 0.822 | 0.734 | 0.715 | 0.4689 |

Table 3 shows the binary classifier results. It is still the Random Forest algorithm that performs the best in this classifier. The precision, recall, and f-measure of all the classifiers are equal, except for the Random Forest algorithm having a bit higher score on precision.

Table 3. (CD) Binary Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.909 | 0.909 | 0.909 | 0.8182 |
| kNN-5 | 0.888 | 0.888 | 0.888 | 0.7762 |
| kNN-7 | 0.86 | 0.86 | 0.86 | 0.7203 |
| Random Forest | 0.924 | 0.923 | 0.923 | 0.8462 |
| J48 | 0.868 | 0.867 | 0.867 | 0.7343 |

Table 4 shows the results of the D binary classifier. The kNN-7 got the lowest algorithm score, while it is still the Random Forest that got the highest score. The scores on precision, recall, and f-measure does not have a significant difference.

Table 4. (D) Binary Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.885 | 0.865 | 0.864 | 0.731 |
| kNN-5 | 0.826 | 0.82 | 0.82 | 0.6409 |
| kNN-7 | 0.8 | 0.798 | 0.797 | 0.5959 |
| Random Forest | 0.904 | 0.899 | 0.899 | 0.798 |
| J48 | 0.865 | 0.865 | 0.865 | 0.7303 |

RUBY

Single Classifier

For the single classifier, the classifier must be able to identify the tweets into the four categories (CA, CD, CH, and D).

Table 1 shows the summary of results for the single classifier. It shows that the Random Forest algorithm got the highest score among all the classifiers. The kNN-7 classifier got the lowest score, and kNN-3 classifier got the highest in the kNN algorithm. The larger the neighbors the lower the score because it is introducing noise.

Table 1. Summary of Single Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.963 | 0.964 | 0.961 | 0.9399 |
| kNN-5 | 0.954 | 0.955 | 0.952 | 0.9254 |
| kNN-7 | 0.943 | 0.943 | 0.938 | 0.9054 |
| Random Forest | 0.978 | 0.978 | 0.977 | 0.9638 |
| J48 | 0.969 | 0.967 | 0.967 | 0.9465 |

Multiple Binary Classifier

For the multiple binary classifier, each classifier will only classify two categories, either it is classified to the classifier’s assigned category or it is not. If it is classified as not belonging to the category, it will cascade onto the next binary classifier until a category is chosen. If the tweet is not categorized at all, only then will it be classified as Others (O)

Table 2 shows the results of the CA binary classifier. Almost all the algorithms got a perfect score for all the measures but the highest scores are from Random Forest and J48, the two algorithms got the same scores.

Table 2. (CA) Binary Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.996 | 0.996 | 0.996 | 0.9921 |
| kNN-5 | 0.996 | 0.996 | 0.996 | 0.9917 |
| kNN-7 | 0.996 | 0.996 | 0.996 | 0.9917 |
| Random Forest | 0.999 | 0.999 | 0.999 | 0.9976 |
| J48 | 0.999 | 0.999 | 0.999 | 0.9976 |

Table 3 lists the results of the CD binary classifier. The algorithms got a high score, Random Forest got a perfect score in all the measures. All the kNN classifiers got the same score in all the measures, even if the number of neighbors increased the score remained the same.

Table 3. (CD) Binary Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.983 | 0.983 | 0.983 | 0.9653 |
| kNN-5 | 0.983 | 0.983 | 0.983 | 0.9653 |
| kNN-7 | 0.983 | 0.983 | 0.983 | 0.9653 |
| Random Forest | 1 | 1 | 1 | 1 |
| J48 | 0.99 | 0.99 | 0.99 | 0.9802 |

Table 4 shows the results of the CH binary classifier. Both the Random Forest and J48 got a perfect score in all the measures, the algorithms correctly classified all the instances.

Table 4. (CH) Binary Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.95 | 0.944 | 0.944 | 0.8889 |
| kNN-5 | 0.932 | 0.921 | 0.92 | 0.8413 |
| kNN-7 | 0.938 | 0.929 | 0.928 | 0.8571 |
| Random Forest | 1 | 1 | 1 | 1 |
| J48 | 1 | 1 | 1 | 1 |

Table 5 lists the D binary classifier results. The Random Forest algorithm correctly classified all the instances, it got a perfect score in all the measures. The kNN classifiers did not reach 0.9 in any measure.

Table 5. (D) Binary Classifier Results

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.891 | 0.86 | 0.858 | 0.7209 |
| kNN-5 | 0.884 | 0.849 | 0.845 | 0.6977 |
| kNN-7 | 0.877 | 0.837 | 0.833 | 0.6744 |
| Random Forest | 1 | 1 | 1 | 1 |
| J48 | 0.989 | 0.988 | 0.988 | 0.9767 |

For <table>, this uses the top 10% features for each category. The table shows that the Random Forest got the highest score with 0.952 F-measure and 0.9219 kappa statistics, while kNN-7 with 0.908 F-measure and 0.8494 kappa statistics.

Table 1. (10%)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.924 | 0.91 | 0.914 | 0.8559 |
| kNN-5 | 0.927 | 0.927 | 0.925 | 0.8793 |
| kNN-7 | 0.908 | 0.909 | 0.905 | 0.8494 |
| Random Forest | 0.953 | 0.952 | 0.952 | 0.9219 |
| J48 | 0.921 | 0.922 | 0.92 | 0.8721 |
| Naïve Bayes | 0.917 | 0.917 | 0.916 | 0.8649 |
| Bayesian Network | 0.931 | 0.93 | 0.928 | 0.8848 |

For <table>, this uses the top 20% features for each category. The table shows that Random Forest has the highest F-measure and kappa statistics, scoring 0.966 and 0.9446 respectively, while kNN-7 scored the lowest with 0.895 F-measure and 0.8376 kappa statistics.

Table 2. (20%)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.936 | 0.934 | 0.931 | 0.8896 |
| kNN-5 | 0.924 | 0.922 | 0.918 | 0.8695 |
| kNN-7 | 0.908 | 0.904 | 0.895 | 0.8376 |
| Random Forest | 0.967 | 0.966 | 0.966 | 0.9446 |
| J48 | 0.931 | 0.931 | 0.93 | 0.8875 |
| Naïve Bayes | 0.926 | 0.925 | 0.925 | 0.8782 |
| Bayesian Network | 0.931 | 0.93 | 0.928 | 0.8848 |

For <table>, this uses the top 30% features for each category. The table shows that Random Forest has the highest F-measure and kappa statistics, scoring 0.964 and 0.943 respectively, while kNN-7 scored the lowest with 0.874 F-measure and 0.984 kappa statistics.

Table 3. (30%)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Algorithm | Precision | Recall | F-measure | Kappa |
| kNN-3 | 0.934 | 0.931 | 0.928 | 0.8857 |
| kNN-5 | 0.916 | 0.912 | 0.906 | 0.8521 |
| kNN-7 | 0.892 | 0.887 | 0.874 | 0.984 |
| Random Forest | 0.966 | 0.965 | 0.964 | 0.943 |
| J48 | 0.928 | 0.929 | 0.927 | 0.98 |
| Naïve Bayes | 0.932 | 0.929 | 0.929 | 0.8851 |
| Bayesian Network | 0.934 | 0.932 | 0.931 | 0.8891 |