Metaclassifiers for Predicting the Robotic Navigational Performance

M. Thanjaivadivel, R. Suguna

Abstract: Prediction of robot steps can be used in path exploring problems and application of data mining techniques towards this constitutes better navigational approaches for robotics. In this paper we apply multi classification for a dataset with four types of movement classes like move-forward, sharp right-turn, slight-right-turn, and slight left-turn in a separate layer. We obtain the results based on Meta classifiers accuracies tabulated. A layered approach is followed for obtaining the more accurate multi-classification.
Keywords: Data Mining, Classifiers, Multiclass, Layered approach, Multi-Classification.

I. INTRODUCTION

Data Mining is the process of discovering meaningful new correlation pattern and trends by shifting through large amount of data stored in repositories, using pattern recognition techniques are used as statistical and mathematical techniques. Data Mining deals with the discovery of hidden knowledge, unexpected patterns and new rules from large database. the way toward finding important new relationship example and patterns by moving through extensive measure of information put away in archives, utilizing design acknowledgment methods are utilized as factual and numerical systems. Data Mining manages the revelation of shrouded learning, startling examples and new principles from huge database. Classification is one of the most popular data mining techniques. Classification predicts categorical discrete unordered labels. In the data mining we have a various types of classification techniques are used such as Decision tree, Fuzzy logic, Meta Classifier and so on.

II. ESTIMATING CLASSIFIER ACCURACY

Estimating classifier accuracy is used to evaluate data accuracy for a given classifier, it will label future data. The main usage classifier is which it wraps to provide additional data preprocessing for feature selection accuracy. Some of the techniques for estimating classifiers are k_fold cross Validation methods and bootstrapping. In this paper Meta Classification methods are implemented. Meta Classification algorithms are Bagging, Dagging, Decorate, AdaBoostM1, and Multi Scheme etc..,

III. PROPOSED LAYERED MODEL

The main characteristics of our model are classified into 2 stages.
The 1st stage classifier, either it Turn or Move Forward.
The 2nd stage classifier, has three sequential layers which can identify three classes.
The dataset categorized into two sets one as 'Turn' another as 'Move Forward', then we implements the layered approach model. It consists of three sequential layers (Layer 1 : Sharp Right Turn, Layer 2 : Slight Right Turn, Layer 3 : Slight Left Turn).
Classification is one of the most popular data mining techniques. Classification predicts categorical discrete unordered labels. In the data mining we have a various types of classification techniques are used such as Decision tree, Fuzzy logic, MetaClassifier and so on.

IV. 4. EXPERIMENTAL ANALYSIS AND RESULTS

4.1 Dataset Description

The Robot Navigation dataset are collected from UCI repository. It navigates or directs the following clockwise direction. It has 4 divisions; using 24 sensors are arranged in circular format. It is in the form of .arff file format. This dataset contains three different files. Each contains particular or unique readings which are used to survey the execution of the classifiers with the information sources. In this we consider the first dataset as it contains more than 5000 attributes and instances [8].
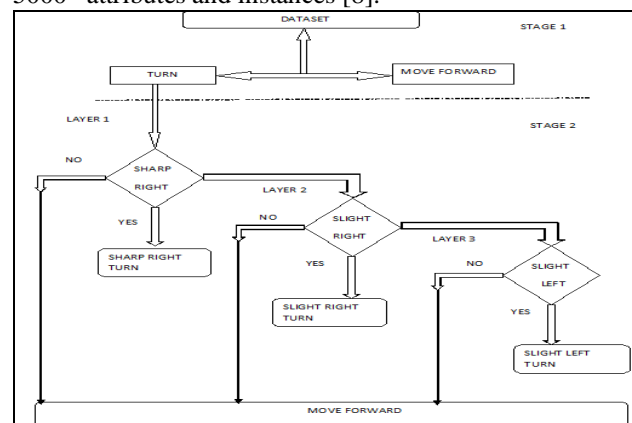

Fig.1 Layered -Model Approach System

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4.2 Attribute Description:

Attributes contains 24 sensor readings and 24 numeric attributes and the class.
Tab1: First Stage Classification

4.3 Tool Used :

Weka is a open source machine learning software that integrates several machine learning tools. The tool is used for for data pre-processing, classification, regression, clustering, association rules, and visualization.

4.4 PERFORMANCE EVALUATION

Let the set of original attribute be L i.e.
1. L={A,B,C,D,E,F,G,H,I,J,K,L,M,N,O,P,Q,R,S,T,U, V,W,X,Y}. While we try to reduce the attribute by eliminating insignificant attributes,
2. Algorithm: 1.CfsSubsetEval attribute Selection BestFirst Original Attribute:
3. L={a,b,c,d,e,f,g,h,i,j,k,l,m,n,o,p,q,r,s,t,u,v,w,x}, List of usage of Attributes 90%---100% Evaluator: weka.attributeSelection.CfsSubsetEval Search: weka.attributeSelection.GeneticSearch

4.4.1 Attribute selection

Layer No	Layer	No. Of attributes selected	Selected Attributes
1	Sharp Right Turn	2	N,O
2	Slight Right Turn	3	N,S,T
3	Slight Left Turn	4	Q,R,S,T,W

TAB 2: Selected Attributes

4.4.2 Classification with Stages

There are two different classification stages, In the first stage the data as partitioned into either move forward or turn. In the second stage the following methods are used describe the accuracy and which is implemented in layered approach system. Each model joins a progression of K learning models. In this paper data mining algorithms are used.

4.4.3 Layer 1

In the first layer the dataset is mined for the pattern whether the robot's next step is turn or move forward, After detecting the 'turn'ing intension of the robot , In the second layer we partitioned the dataset into either move forward or slight right. This layer dedicated to emphasis on 'sharp right' behavior.

Layer 1 is carried out as shown in fig1for classification. The classification accuracy is shown in Table 2.

Sno	Algorithm Name	Base classifier	Time to built	Accuracy
1	Bagging	REPTree	0.26 seconds	96%
2	Dagging	SMO	1.42seconds	56%
3	Decorate	J48	5.16seconds	90%
4	Multiclass Classifier	Logistic	0.89 seconds	63%
5	MultiBoost AB	Decision Stump	0.45 seconds	69%

TAB 3 : Selected Attributes

| List of attribute	No of folds %	Selected attribute
A	0(0%)	-
B	0(0%)	-
C	0(0%)	-
D	0(0%)	-
E	0(0%)	-
F	0(0%)	-
G	0(0%)	-
H	0(0%)	-
I	0(0%)	-
J	0(0%)	-
K	0(0%)	-
L	0(0%)	-
M	10(100%)	˅
N	10(100%)	˅
O	10(100%)	˅
P	0(0%)	-
Q	0(0%)	-
R	10(100%)	˅
S	10(100%)	˅
T	10(100%)	˅
U	0(0%)	-
V	0(0%)	-
W	0(0%)	-
X	0(0%)	-

4.4.3.1 Sharp-Right-Turn Layer:

The results of Stage 2 Sharp-Right-Turn Layer are shown in table 3.

Methods	Correctly classified	Incorrectly classified	Time to built
Bagging	99.7617 %	0.2383 %	0.94 seconds
Dagging	80.6085 %	19.3915 %	1.15 seconds
Decorate	99.8167 %	0.1833 %	23.73 seconds
Multiclass Classifier	80.187 %	19.813 %	0.48 seconds
MultiBoost AB	91.0924 %	8.9076 %	0.75 seconds

TABLE 2: Layer 1 Classification of Sharp_Right_Turn
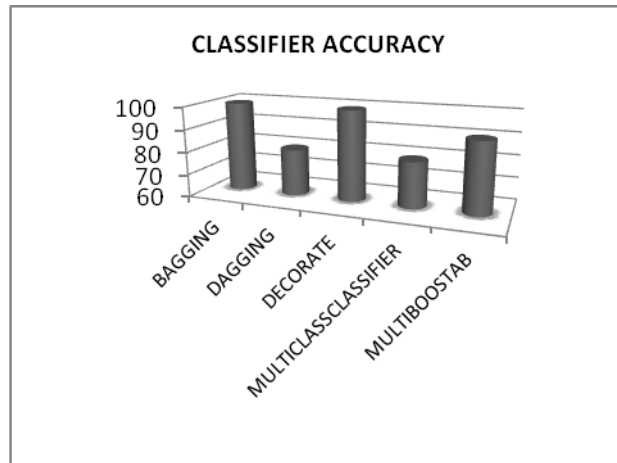
GRAPH 1: Performance comparison for Sharp-Right-Turn.
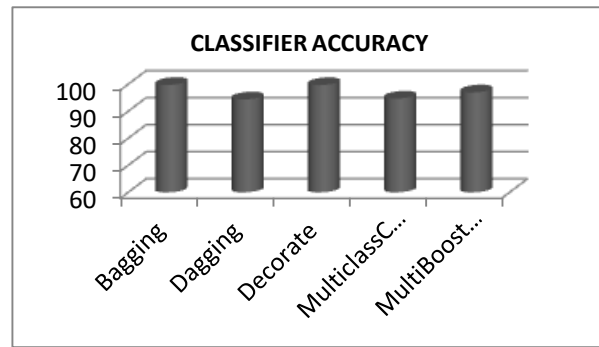
4.4.4 Layer 2

In the second layer we partitioned the dataset into either move forward or slight right. This layer dedicated to emphasis on 'slight right turn' behavior. Layer 2 is carried out as shown in fig1 for classification. The classification accuracy is shown in Table 2.

4.4.4.1 Slight-Right-Turn Layer:

The results of Stage 2 Slight-Right-Turn Layer are shown in table 3.

Methods	Correctly classified	Incorrectly classified	Time to built
Bagging	99.6518 %	0.3482 %	0.94 seconds
Dagging	85.9604 %	14.0396 %	0.72 seconds
Decorate	99.5601 %	0.4399 %	35.04 seconds
Multiclass Classifier	88.3431 %	11.6569 %	0.44 seconds
MultiBoost AB	90.6708 %	9.3292 %	0.94 seconds

TABLE 3: Layer 1 Classification of Slight_Right_Turn

GRAPH 2: Performance comparison for Slight_Right_Turn

4.4.5 Layer 3

In the third layer we partitioned the dataset into either move forward or slight left. This layer dedicated to emphasis on 'slight left turn' behavior.

4.4.5.1 Slight-Left-Turn Layer:

The results of Stage 2 Slight-Left-Turn Layer are shown in table 3.

Methods	Correctly classified	Incorrectly classified	Time to built
Bagging	99.7617 %	0.2383 %	0.7 seconds
Dagging	94.3915 %	5.6085 %	0.73 seconds
Decorate	99.7067 %	0.2933 %	24.27 seconds
Multiclass Classifier	94.7031 %	5.2969 %	0.61 seconds
MultiBoost AB	96.9941 %	3.0059%	0.84 seconds

**TABLE 4: Layer 3 Classification of Slight_ Left_Turn**
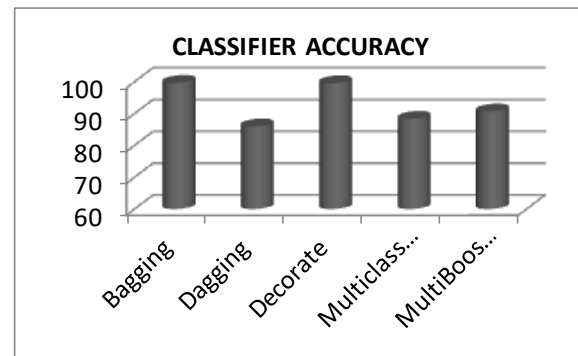
GRAPH 2: Performance comparison for Slight_Left_Turn

The classification is depends on the performance of the data to be classified. In this paper initially selected k-fold cross validation and some techniques are used. Assessing classifier exactness is critical in that it enables one to assess how precisely a given classifier will mark future information.

Metaclassifiers for Predicting the Robotic Navigational Performance

The main usage classifier is which it wraps to provide additional data preprocessing for feature selection accuracy. Some of the techniques for estimating classifiers are k_fold cross Validation methods and bootstrapping. A multi-layered approach for foreseeing the robot that advances or turn for better execution utilizing diverse classifier strategies has been created to accomplish high productivity and characterization rate precision. The proposed framework comprises of two phases. Initially arrange is development distinguishing proof and the second stage is order. The data is input in the first Stages which identify whether it is turn or move forward. Experimental results indicate that the proposed layered model with MetaClassifier on multiple dataset can be classified.

The Meta Classification Methods are Bagging, Dagging, Decorate, Multiclass Classifier and MultiBoostAB. Compared to all the Classifier Bagging is the best method for calculating the accuracy and it takes less time to build the model [9].
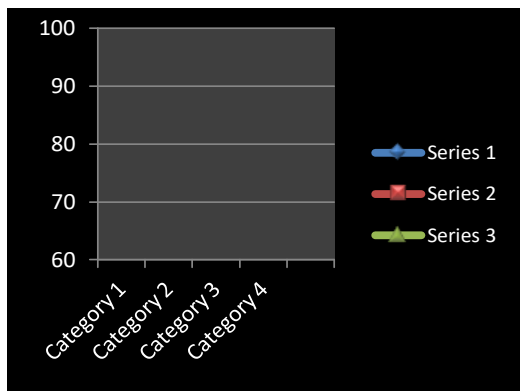
GRAPH 3: Performance comparison for three Layers

V.   RESULTS AND CONCLUSION

We perform number of iterations on training and testing samples of selected robot's sensor data. Our approach will add strength to the robotic navigation for predicting the next step by not only the sensor but also the described predictions on patterns of navigations. Our results show the meta classifiers yield best accuracy for navigational path finding. A multi-layered approach for predicting the robot that moves forward or turn for better performance using different classifier methods has been developed to achieve high efficiency and classification rate accuracy. The proposed system consists of two stages. First stage is movement identification. In the second stage for further classification. Experimental results indicate that the proposed layered model with one of Meta Classifier i.e. bagging yields most accuracy in the evaluation.

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