Colored Petri Nets Construction for Predicting the Gender Classification Based on Human Body

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Abstract
Today gender classification is an extremely difficult problem in a real-time application based on face recognition. Future trends will see a rise in demand for gender-based real-time applications. Some have suggested several methods for automatically classifying gender using physical characteristics of humans. We use data mining experiments using the proper gender classification dataset to conduct possible research. The first step is to extract the best applicable rules, and the second is to build a concurrent execution model, which is a Colored Petri net. The aim of this study is to find a high accuracy rule set for generating Fuzzy Petri nets and then implement it using a Colored Petri nets simulator.
Key words: Colored Petri Nets, Classifiers, Data mining, Fuzzy Petri Nets, Predictors, WEKA, Gender Classification.

Introduction:

Gender is an important factor in social relationships. Despite the fundamental importance these characteristics play in our daily lives, the capacity to estimate them consistently and reliably from human faces is still far from satisfying the demands of commercial applications. This is especially surprising in light of recent claims of superhuman powers in the related job of facial recognition. Data mining techniques play an important role in all fields of gender classification research and improvement. It has different goals in each application area. These objectives are frequently difficult to compute and necessitate their own set of measurement procedures. It is the discovery of patterns in data that give insight or allow for quick and precise decision making [2].

In this paper, we are going to classify the human gender based on human face feature, such as: long hair, forehead width, forehead weight, nose wide, nose long, lips thin, distance nose to lip. We have to classify the entire human face feature using 3 classification algorithms, such as JRip, PART and ONE R.

1. METHODS AND MATERIAL

1.1 Fuzzy Petri Nets

A Fuzzy Petri Net model (FPN) [1] is Petri net having places and transitions, where places are denoted by rings and transitions are denoted by rectangles. Each place represents an antecedent or consequent and will or might not contain a token related to a truth degree between zero and one that represents the live of trust at intervals the legitimacy of the antecedent or consequent. Every transition representing a rule is related to a certainty issue price between zero and one. The certainty factor represents the strength of the belief in the rule. The relationships between places and transitions are represented by directed arcs (Edges), arcs exist only between places and transitions and vice versa.

1.2 Colored Petri Net

CPN is a graphical language that may be used to build models of concurrent systems and analyse their characteristics. The CPN can be used to model non-deterministic and stochastic processes. It also provides a modelling framework for simulating distributed and concurrent processes with synchronous and asynchronous communication [4]. CPN model is an executable representation of the system that includes system state, events, or transitions that allow the system to change state. With the aid of a CPN model simulation, it is possible to evaluate and investigate numerous situations and system behaviour. CPN is a graphical component of standard Petri nets combined with a high level programming language.

1.3 WEKA

WEKA is a data mining algorithm. WEKA stands for the Waikato Environment for Knowledge Analysis [5] It is a data mining/machine learning tool created by the Department of Computer Science at the University of Waikato in New Zealand. WEKA is an open-source software system licenced under the GNU General Public License. WEKA provides three methods for injecting data for preprocessing and predicting nominal or numeric values.

2.3 Data set:

The experimental data in this paper is gained through kaggle. The dataset named: Gender Classification Dataset. This dataset consist of 5001 data (50% classified as male and 50% classified as female.

2.3.1 Data set Description

The data set consists of 7 input attributes and 1 target attribute, where

long*hair* - This column contains 0's and 1's where 1 is "long hair" and 0 is "not long hair".

fore head width *cm* - This column is in CM's. This is the width of the forehead.

fore head height *cm* - This is the height of the forehead and it's in Cm's.

nose wide - This column contains 0's and 1's where 1 is "wide nose" and 0 is "not wide nose".

nose *long* - This column contains 0's and 1's where 1 is "Long nose" and 0 is "not long nose".

lips thin - This column contains 0's and 1's where 1 represents the "thin lips" while 0 is "Not thin lips".

distance *nose* to *lip* long - This column contains 0's and 1's where 1 represents the "long distance between nose and lips" while 0 is "short distance between nose and lips".

gender - This is either "Male" or "Female".

2. Methodology

We used three rule based classifier in this paper to evaluate the effectiveness of those classifiers in the classification problem.

3.1 JRIP Classifier:

Jrip has classes that are examined in increasing size. It's one of the notable algorithms. It also includes a set of rules for a class is generated using reduced error Jrip. In this classifier, the test option is cross validations with 10 folds. J Rip produces the accuracy 97.46 and Mean Absolute error 0.0438. In our testing, the number of rules was 7, and the time consumed was 0.91 seconds.

3.2 ONE R Classifier:

In this, a single rule is created for each attribute of the triangular data and then picks up the rule with the least error rate. The most recurrent class for each attribute values must be established for generating a rule. In this classifier, the test option is cross validations with 10 folds. ONE R produces the 87.36 accuracy and Mean Absolute error 0.1264. In our testing, the number of rules was 2, and the time consumed was 0.04 seconds.

3.3 PART Classifier

Class for generating a PART decision list. It uses separate and conquers. A Partial C4.5 decision tree is constructing in each iteration. The best leaf is made a rule. In this classifier, the test option is cross validations with 10 folds. In this classifier PART produces the accuracy 97.45 and Mean Absolute error 0.0433. In our testing, the number of rules was 23, and the time consumed was 0.26 seconds.

3. RESULT AND DISCUSSION:

To apply the Gender Classification data set in WEKA tool for Data processing. We tested many classification criteria to determine the best accuracy and the least amount of error. Finally, determine the evaluation model and use it to run simulating the Model using CPN. For each machine algorithm, the classification accuracy, mean absolute error, and root mean squared error are computed. When compared to other algorithms, a JRip classification method works well since it has the least error and highest accuracy.

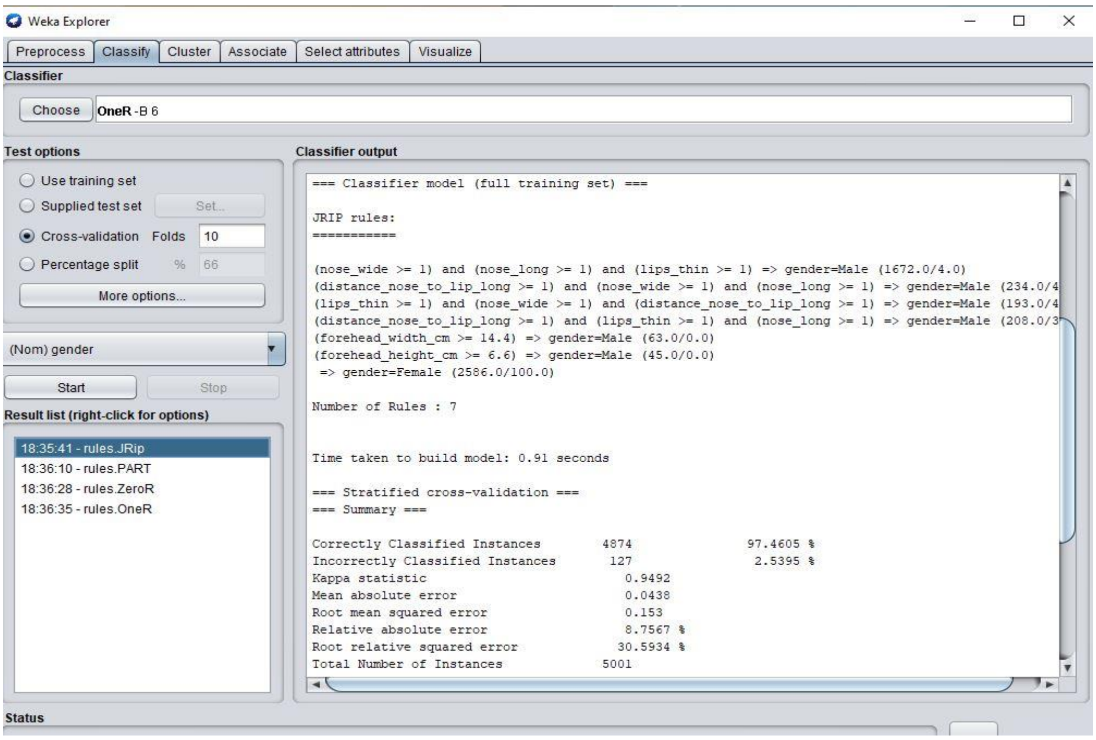

Figure: 1 Classifier Output of the JRip Model

A JRip Classifier is generating the following seven rules:

R1: nose_wide >=1) and (nose_long >= 1) and (lips_thin >= 1) => gender=Male

R2: (distance_nose_to_lip_long >= 1) and(nose_wide >= 1)and (nose_long>= 1)=>gender=Male

R3: (lips_thin >=1) and (nose_wide >= 1) and(distance_nose_to_lip_long>=1 => gender=Male

R4: (distance_nose_to_lip_long >= 1) and (lips_thin >= 1) and(nose_long>=1) => gender=Male

R5: (forehead_width_cm >= 14.4) => gender=Male

R6: (forehead_height_cm >= 6.6) => gender=Male

R7: => gender=Female

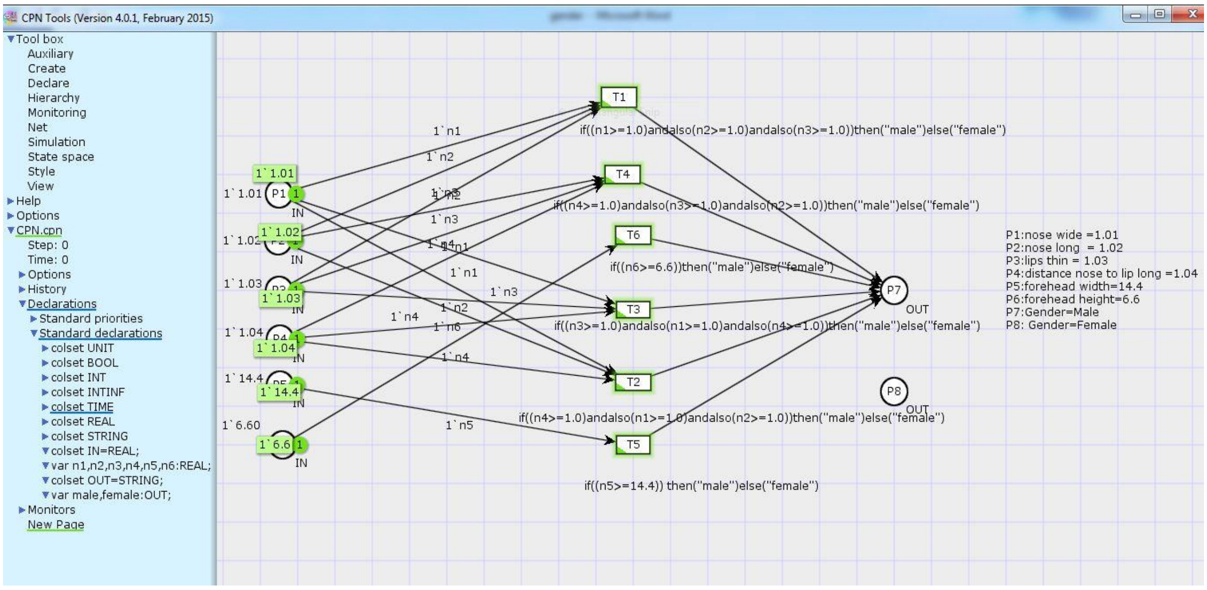

Figure: 1 CPN tool Snap shot for before firing the transition

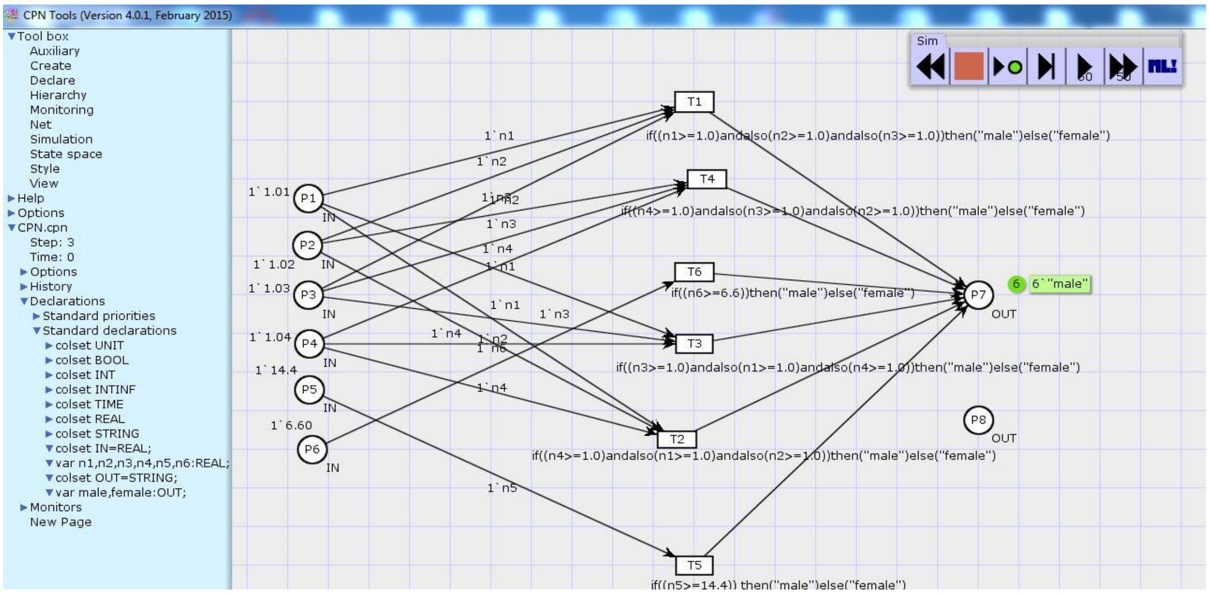

Figure: 2 CPN tool Snap shot for after firing the transition

We execute the above rules in Simulating the Model with CPN is illustrated in Fig: 2 & 3. In the Colored Petri net model [6, 7] According to the proportions dedicated to each place, transitions 1 to 7 respectively represent rules 1 to 7 in the introduced rule base above and firing each transition means the corresponding rule is fulfilled.

4. Conclusion:

In this work, we have shown how the CPN tool can be used to provide a clear specification for gender classification based on physical characteristics of the human body. The rules are constructed using the Jrip algorithm, which is implemented in WEKA, and are

presented as input to the Colored Petri nets simulation tool. This work can be extended with more number of attributes which influence the consequents of the rules.

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