

# CSE521 DATA MINING PROJECT SPRING 2023 (30pts)

**TEAM NUMBER:**            TEAM Leader **NAME** and **ID:**

Team members **NAMES** and **IDs:**

- 1.
- 2.
- 3.
- 4.
- 5.

## **FORMAT OF SUBMISSION**

1. The TEAM LEADER submits **ONE PDF** file for the TEAM
2. Name your PDF file as `<TEAMLEADERID>.pdf`

**Example:**    11384578.pdf

**All team members receive the same grade.**

## **PROJECT DESCRIPTION**

**PROJECT REPORT LENGTH** - the report must be concise and well thought out and can not exceed 15 pages. We will deduce points for each page above the limit.

### **PROJECT GOAL**

The main goal of the project is to use the Project Data and 2 Internet based Classification TOOLS to conduct 3 Experiments of building **descriptive** Decision Tree classifier and **non-descriptive** Neural Network classifier for the same sets of DATA.

For each Experiment you have to compare descriptive and non-descriptive obtained results and describe and compare the functionality of the TOOLS used.

### **PROJECT TOOLS**

TOOL WEKA:    <https://www.cs.waikato.ac.nz/ml/weka/>

LIST OF TOOLS    <https://www.softwaretestinghelp.com/data-mining-tools/>

Use WEKA for the Project and compare WEKA functionality and WEKA's results with ONE other tool of your choice. You must describe shortly the TOOL and your decision to use it.

**PROJECT DATA** is provided on the course web page.

This is a real life classification data with TYPE DE ROCHE (Rock Type) as a CLASS attribute.

There are 98 records with 48 attributes and 6 classes.

**Classes are:**

**C1** : R. Carbonatees AND R. Carbonatees impures

**C2** : Pyrate

**C3** : Charcopyrite

**C4** : Galene

**C5** : Spahlerite

**C6** : Sediments terrigenes

**Most important attributes** (as determined by the expert) are: **S, Zn, Pb, Cu, CaO+MgO, CaO, MgO, Fe2O3**

This is a real life experimental data and it contains a lot of missing data (no value) and not ready to use without some preprocessing

## **PROJECT STEPS**

Project follows the following steps of **DM Process** to build the classifiers.

### **S1: Data Preparation (2pts)**

Use attributes selection, cleaning the data, filling the missing values, etc... operations to build your Project DATA - **PD**

Create Project EXPERT DATA - **PED** as a subset of Project DATA - **PD** using only the most important attributes **S, Zn, Pb, Cu, CaO+MgO, CaO, MgO, Fe2O3** as determined by the expert.

### **S2: Data preprocessing (3pts)**

1. For the Decision Trees **Descriptive Classifier** you use your chosen method of the **discretization** of Project DATA - **PD** creating a set **PD1** of data with no more than 4 values (bins) for each attribute. Different attributes do not need to have the same number of values (bins) and you do not

need to use the same discretization methods for all of them. Describe which discretization method (must use at least two) you used for each attributes.

Create the EXPERT DATA - **PED1** from the **PD1** by using only the most important attributes **S, Zn, Pb, Cu, CaO+MgO, CaO, MgO, Fe2O3**.

2. For the Neural Network **Non - Descriptive Classifiers** use your chosen method of normalization of the Project DATA - **PD** and Project EXPERT DATA - **PED**. Specify which.

### **S3: Building Classifiers (25pts)**

1. For the Decision Tree **Descriptive Classifiers** use the sets of data **PD, PED** for **Experiments 1, 2** and **PD1, PED1** for **Experiment 3**.
2. For the Neural Network **Non- Descriptive Classifiers** use the normalized sets of data **PD, PED**. Use at least TWO different Network TOPOLOGIES; one can be the Tool default one, and the other designed by you. Compare results.

### **PROJECT TOOLS**

Use WEKA and a TOOL of your choice to build classifiers conducting **Experiments 1, 2** and only WEKA for **Experiment 3**.

### **PROJECT Classification STEPS for EXPERIMENTS 1 and 2**

.1 (5pts)

For each TOOL and each set of DATA and each EXPERIMENT describe shortly the resulting Classifier and the parameters (testing method, network topology, number of epochs to converge... type of Decision Tree, write set of discriminant rules. etc..) used to build it.

2. (5pts)

**Compare** the resulting **Descriptive Classifiers** with each other testing methods, Rules Accuracy and Predictive Accuracy

3. (5pts)

**Compare** the resulting **Non Descriptive Classifiers** with each other on topology used testing method and predictive accuracy

4. (5pts)

**Compare** each **Descriptive Classifier** with the resulting **Non-Descriptive Classifier** on Predictive Accuracy only.

5. (5pts)

**Describe** shortly the TOOLS you use.

**Describe** their similarity and differences for the tasks you used them for.

**Describe** your experience with the TOOLS and your preferences for one or the other regarding different tasks.

### **EXPERIMENTS 1- 3**

#### **Experiment 1**

Use the **PD** and **PED** data to perform the **full classification**, i.e. to build Decision Tree classifier, and Neural Network Classifier for all classes **C1- C6** simultaneously.

#### **Experiment 2**

Use the **PD** and **PED** data to perform the **contrast classification** for the class **C1** i.e. to build a Decision Tree classifier, and Neural Network Classifiers contrasting the class **C1** with a class **notC1** that contains other classes.

#### **Experiment 3 (5 extra points)**

Use **PD1** and **PED1** data and **only** WEKA Decision Tree to build two kind of **contrast classifiers** for the class **C1** for each set **PD1, PED1** of data.

1. Classifier **M1** with branches grown for each known value of each attribute.
2. Classifier **M2** with only binary branches.

**Write** obtained classifiers as sets of discriminant rules in predicate form.

**Compare** the classifiers built out of **PD1** and **PED1** data on base of predictive accuracy and rules accuracy.