UNC CHARLOTTE

FSI Analysis

KDD Project

Department of Computer Science
University of North Carolina Charlotte, NC, USA

Instructor
Dr. Zbigniew W. Ras

Team:
Chirag Jain (801076737)
Upasana Pattnaik (801081007)

Table of Contents

What is Fragile State Index?	3
Description of Problem Statement	4
Choice of Additional 6 Features	5
Preprocessing Methods	6
Report and Analysis of Classification Results	7
Report and Analysis of Action Rule Mining	30

1. **What is Fragile State Index?**

   The Fragile States Index (FSI) is a critical tool produced by the Fund For Peace to annually rank 178 countries based twelve key cohesion, political, social and economic indicators and over a 100 sub-indicators which indicate their levels of fragility. It assesses a country's vulnerability to conflict. This analytical approach is based on a comprehensive social science methodology developed after years of social science research. After millions of documents are analyzed- quantitative, qualitative and expert validation data streams are validated to obtain the final scores.

   The sum of scores of twelve distinctive features- Demographic Pressures, Refugees and IDPs, Group Grievance, Human Flight, Uneven Development, Poverty and Economic Decline, State Legitimacy, Public Services, Human Rights, Security Apparatus, Factionalized Elites, External Intervention are indicative of a country's stability.

   ● Social Indicators

   1. Demographic Pressures: The relative ratio of high population density and other resources like food and water.
   2. Refugees and IDPs: The immigration of the general population that can affect security and other resources.
   3. Group Grievance: The existing violence between communities that can threaten the country's security.
   4. Human Flight: The migration-per-capita especially immigration of educated people who moves out of countries for a better opportunity.

   ● Economic Indicators

   5. Poverty and Economic Decline: The economic decline of the society as a whole that affects the country's ability to provide a better outcome.

6. Uneven Development: The inequality in different genres like work, education, financial that negatively impact the social construct of a country.

- Political Indicators

7. State Legitimacy: The corruption in the higher level of a state's community.
8. Public Services: The lack of important services like healthcare, education, cleanliness, transportation which affects the performance of a state.
9. Human Rights: The weak protection of basic rights indicates the failure of a state to perform its primary responsibility.
10. Security Apparatus: An emergence of elite or praetorian guards that operate with impunity challenges the security apparatus' monopoly on the use of force, weakening the social contract. Measurements include internal conflict, riots/protests, military coups, rebel activity.
11. Factionalized Elites: Measured by power input from elite groups and corrupted elections.
12. External Intervention: Measured by foreign assistance, presence of peacekeepers or UN missions, foreign military intervention, sanctions, and credit ratings.

2. Description of Problem Statement

The Fragile States Index (FSI) is the decision feature. It is the sum total of all the feature scores in the data set. The FSI scores should be interpreted with the understanding that the lower the score, the better. A reduced score indicates an improvement and greater relative stability and a higher score indicates greater instability.

Our goal is to find a set of action rules from the dataset that would allow assessment into how a country can transfer from Alert to Warning or Stable(defined in section 4).

Our dataset's decision feature FSI Score or 'Total' needs to be discretized. The action rules we generate should suggest what changes in values of features are needed to lower FSI.

3. **The choice and justification of additional 6 features, along with the method and source for their extraction.**
   The six features we have extracted are selected for their insight into a country's socio-economic status and its impact on fragility based on security, economics, census, education, and environment. These are important aspects that provide an intuitive understanding of a country's fragility status and can aid in augmenting the pre-existing features with their addition.
   Using the country's name is the common index, the columns were merged into the main FSI dataset.

   New features selected-

   - Global Terrorism Index(GTI): It represents the ranking of the countries which is based on the terrorist activities happened over a period of time.

   - Total Unemployment Rate: It represents the total number of people who are unemployed in the country .

   - Education Index: It is calculated as the number of expected years a child spends in a given level of education to the average number of completed years of education of people. Education is a vital criteria for assessing the development of a country.

   - Life Expectancy At Birth: Number of years a newborn infant is expected to live assuming that the existing patterns of age-specific mortality rates during his infant's stay same throughout the infant's life.

● Environmental Performance Index (EPI): It defines the condition of a country's environment. It can be also defined as a measure of the environment's health quality.

● Prison Population: It defines the number of adults and juvenile prisoners present per 1 million people.

The values for these extended features have been extracted from various websites and added to the original FSI dataset. The data for three consecutive years- 2013, 2014 and 2015. Sources for the extended features are listed below:

● Human Development Reports: http://hdr.undp.org/en/data
● World Bank Open Data: https://data.worldbank.org

4. Description of all the preprocessing methods performed on the datasets.

i) Discretization: The continuous target feature FSI score 'Total'(in the dataset) is categorized based on the FSI's categories using Weka.

Alert - 90.0 to 120.0 FSI Score
Warning - 60.0 to 89.9 FSI Score
Stable - 30.0 to 59.9 FSI Score
Sustainable - 0.0 to 29.9 FSI Score
Not Assessed - N/A

Source: https://en.wikipedia.org/wiki/Fragile_States_Index

ii) New Feature Addition: Six new features were added to the three datasets in Excel- Global Terrorism Index(GTI), Total Unemployment Rate, Education Index, Life Expectancy At Birth, Environmental Performance Index (EPI) and Prison Population.

iii) New Discretization: After adding the six new features, the 'Total' FSI score changes, to accommodate this shift, the categories are scaled to suit the new scores' discretization.

Alert - 110.0 to 180.0 FSI Score
Warning - 80.0 to 109.9 FSI Score
Stable - 50.0 to 79.9 FSI Score
Sustainable - 0.0 to 49.9 FSI Score
Not Assessed - N/A

Additionally, there were no null or missing values present in the dataset.

5. Report and analysis of classification results.

We have used WEKA for classification purposes. Each model goes through 10-Fold Cross Validation. The classification result summary for each model is provided.

The four classification models used to analyze the datasets are:

1. Naive Bayes: It is a probabilistic classifier based on Bayes' theorem that makes classifications using the Maximum A Posteriori decision rule in a Bayesian setting.
2. J48: It is a statistical classifier used to generate a decision tree. It is an extension of ID3 algorithm.
3. Random Forests: It builds an ensemble of Decision Trees, most of the time trained with the "bagging" method to get more stable and accurate predictions. It can be used for both classification and regression tasks.
4. JRip: It implements a propositional rule learner, Repeated Incremental Pruning to Produce Error Reduction (RIPPER), which is an optimized version of IREP. Based in association rules with reduced error pruning (REP).

Report
Before Addition of Features

**** 2013 ****

1. Naive Bayes

```
Time taken to build model: 0.07 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         174               97.7528 %
Incorrectly Classified Instances         4                2.2472 %
Kappa statistic                          0.9655
Mean absolute error                      0.0178
Root mean squared error                  0.1052
Relative absolute error                  5.4548 %
Root relative squared error             26.0604 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 1.000    0.000    1.000      1.000    1.000      1.000    1.000     1.000     Alert
                 1.000    0.011    0.989      1.000    0.994      0.989    1.000     1.000     Warning
                 0.921    0.007    0.972      0.921    0.946      0.932    0.998     0.993     Stable
                 0.929    0.012    0.867      0.929    0.897      0.888    0.999     0.987     Sustainable
Weighted Avg.    0.978    0.008    0.978      0.978    0.978      0.971    0.999     0.997

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 36  0  0  0 |  a = Alert
  0 90  0  0 |  b = Warning
  0  1 35  2 |  c = Stable
  0  0  1 13 |  d = Sustainable
```

2. J48

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9738
Mean absolute error                      0.0084
Root mean squared error                  0.0918
Relative absolute error                  2.6095 %
Root relative squared error             22.8847 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.971    0.000    1.000      0.971    0.985      0.982    0.985     0.976     Alert
                 0.989    0.012    0.989      0.989    0.989      0.978    0.989     0.984     Warning
                 0.974    0.007    0.974      0.974    0.974      0.967    0.984     0.955     Stable
                 1.000    0.006    0.929      1.000    0.963      0.961    0.997     0.929     Sustainable
Weighted Avg.    0.983    0.008    0.984      0.983    0.983      0.975    0.988     0.972

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 33  1  0  0 |  a = Alert
  0 91  1  0 |  b = Warning
  0  0 38  1 |  c = Stable
  0  0  0 13 |  d = Sustainable
```

3. Random Forest

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         139               78.0899 %
Incorrectly Classified Instances        39               21.9101 %
Kappa statistic                          0.6165
Mean absolute error                      0.2319
Root mean squared error                  0.2949
Relative absolute error                 71.8036 %
Root relative squared error             73.5111 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.235    0.000    1.000      0.235    0.381      0.446    1.000     1.000     Alert
                 1.000    0.407    0.724      1.000    0.840      0.655    0.999     0.999     Warning
                 0.949    0.029    0.902      0.949    0.925      0.904    0.999     0.995     Stable
                 0.154    0.000    1.000      0.154    0.267      0.380    0.999     0.982     Sustainable
Weighted Avg.    0.781    0.217    0.836      0.781    0.729      0.650    0.999     0.997

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
  8 26  0  0 |  a = Alert
  0 92  0  0 |  b = Warning
  0  2 37  0 |  c = Stable
  0  7  4  2 |  d = Sustainable
```

4. JRIP

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9736
Mean absolute error                      0.0084
Root mean squared error                  0.0918
Relative absolute error                  2.6095 %
Root relative squared error             22.8847 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.971    0.000    1.000      0.971    0.985      0.982    0.985     0.976     Alert
                 1.000    0.023    0.979      1.000    0.989      0.978    0.988     0.979     Warning
                 0.974    0.007    0.974      0.974    0.974      0.967    0.984     0.955     Stable
                 0.923    0.000    1.000      0.923    0.960      0.958    0.962     0.929     Sustainable
Weighted Avg.    0.983    0.014    0.983      0.983    0.983      0.975    0.985     0.969

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 33  1  0  0 |  a = Alert
  0 92  0  0 |  b = Warning
  0  1 38  0 |  c = Stable
  0  0  1 12 |  d = Sustainable
```

**** 2014 ****

1. Naive Bayes

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9738
Mean absolute error                      0.0122
Root mean squared error                  0.0907
Relative absolute error                  3.7656 %
Root relative squared error             22.6013 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 1.000    0.000    1.000      1.000    1.000      1.000    1.000     1.000     Alert
                 1.000    0.000    1.000      1.000    1.000      1.000    1.000     1.000     Warning
                 0.949    0.007    0.974      0.949    0.961      0.950    0.992     0.925     Stable
                 0.923    0.012    0.857      0.923    0.889      0.880    0.992     0.955     Sustainable
Weighted Avg.    0.983    0.002    0.984      0.983    0.983      0.980    0.998     0.980

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 34  0  0  0 |  a = Alert
  0 92  0  0 |  b = Warning
  0  0 37  2 |  c = Stable
  0  0  1 12 |  d = Sustainable
```

2. J48

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9738
Mean absolute error                      0.0084
Root mean squared error                  0.0918
Relative absolute error                  2.6095 %
Root relative squared error             22.8847 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.971    0.000    1.000      0.971    0.985      0.982    0.985     0.976     Alert
                 0.989    0.012    0.989      0.989    0.989      0.978    0.989     0.984     Warning
                 0.974    0.007    0.974      0.974    0.974      0.967    0.984     0.955     Stable
                 1.000    0.006    0.929      1.000    0.963      0.961    0.997     0.929     Sustainable
Weighted Avg.    0.983    0.008    0.984      0.983    0.983      0.975    0.988     0.972

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 33  1  0  0 |  a = Alert
  0 91  1  0 |  b = Warning
  0  0 38  1 |  c = Stable
  0  0  0 13 |  d = Sustainable
```

3. Random Forest

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         139               78.0899 %
Incorrectly Classified Instances        39               21.9101 %
Kappa statistic                          0.6165
Mean absolute error                      0.2319
Root mean squared error                  0.2949
Relative absolute error                 71.8036 %
Root relative squared error             73.5111 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.235    0.000    1.000      0.235    0.381      0.446    1.000     1.000     Alert
                 1.000    0.407    0.724      1.000    0.840      0.655    0.999     0.999     Warning
                 0.949    0.029    0.902      0.949    0.925      0.904    0.999     0.995     Stable
                 0.154    0.000    1.000      0.154    0.267      0.380    0.999     0.982     Sustainable
Weighted Avg.    0.781    0.217    0.836      0.781    0.729      0.650    0.999     0.997

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
  8 26  0  0 |  a = Alert
  0 92  0  0 |  b = Warning
  0  2 37  0 |  c = Stable
  0  7  4  2 |  d = Sustainable
```

4. JRip

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9736
Mean absolute error                      0.0084
Root mean squared error                  0.0918
Relative absolute error                  2.6095 %
Root relative squared error             22.8847 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.971    0.000    1.000      0.971    0.985      0.982    0.985     0.976     Alert
                 1.000    0.023    0.979      1.000    0.989      0.978    0.988     0.979     Warning
                 0.974    0.007    0.974      0.974    0.974      0.967    0.984     0.955     Stable
                 0.923    0.000    1.000      0.923    0.960      0.958    0.962     0.929     Sustainable
Weighted Avg.    0.983    0.014    0.983      0.983    0.983      0.975    0.985     0.969

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 33  1  0  0 |  a = Alert
  0 92  0  0 |  b = Warning
  0  1 38  0 |  c = Stable
  0  0  1 12 |  d = Sustainable
```

**** 2015 ****

1. Naive Bayes

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         166               93.2584 %
Incorrectly Classified Instances        12                6.7416 %
Kappa statistic                          0.8973
Mean absolute error                      0.0305
Root mean squared error                  0.1538
Relative absolute error                  9.2015 %
Root relative squared error             37.8636 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.892    0.014    0.943      0.892    0.917      0.896    0.997     0.988     Alert
                 0.966    0.056    0.944      0.966    0.955      0.910    0.996     0.996     Warning
                 0.921    0.021    0.921      0.921    0.921      0.900    0.997     0.988     Stable
                 0.867    0.012    0.867      0.867    0.867      0.854    0.997     0.974     Sustainable
Weighted Avg.    0.933    0.036    0.933      0.933    0.932      0.900    0.996     0.991

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 33  4  0  0 |  a = Alert
  2 85  1  0 |  b = Warning
  0  1 35  2 |  c = Stable
  0  0  2 13 |  d = Sustainable
```

2. J48

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9745
Mean absolute error                      0.0084
Root mean squared error                  0.0918
Relative absolute error                  2.5453 %
Root relative squared error             22.594  %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.973    0.000    1.000      0.973    0.986      0.983    0.986     0.979     Alert
                 0.989    0.011    0.989      0.989    0.989      0.978    0.989     0.983     Warning
                 0.974    0.007    0.974      0.974    0.974      0.967    0.983     0.954     Stable
                 1.000    0.006    0.938      1.000    0.968      0.965    0.997     0.938     Sustainable
Weighted Avg.    0.983    0.008    0.983      0.983    0.983      0.975    0.988     0.972

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 36  1  0  0 |  a = Alert
  0 87  1  0 |  b = Warning
  0  0 37  1 |  c = Stable
  0  0  0 15 |  d = Sustainable
```

3. Random Forest

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         142               79.7753 %
Incorrectly Classified Instances        36               20.2247 %
Kappa statistic                          0.6661
Mean absolute error                      0.2418
Root mean squared error                  0.3039
Relative absolute error                 73.0395 %
Root relative squared error             74.7965 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.351    0.000    1.000      0.351    0.520      0.548    1.000     1.000     Alert
                 0.989    0.344    0.737      0.989    0.845      0.681    0.995     0.996     Warning
                 0.921    0.036    0.875      0.921    0.897      0.869    0.994     0.978     Stable
                 0.467    0.000    1.000      0.467    0.636      0.667    0.996     0.947     Sustainable
Weighted Avg.    0.798    0.178    0.843      0.798    0.771      0.692    0.996     0.989

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 13 24  0  0 |  a = Alert
  0 87  1  0 |  b = Warning
  0  3 35  0 |  c = Stable
  0  4  4  7 |  d = Sustainable
```

4. JRip

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9743
Mean absolute error                      0.0084
Root mean squared error                  0.0918
Relative absolute error                  2.5453 %
Root relative squared error             22.594  %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.973    0.000    1.000      0.973    0.986      0.983    0.986     0.979     Alert
                 1.000    0.022    0.978      1.000    0.989      0.978    0.989     0.978     Warning
                 0.974    0.007    0.974      0.974    0.974      0.967    0.983     0.954     Stable
                 0.933    0.000    1.000      0.933    0.966      0.963    0.967     0.939     Sustainable
Weighted Avg.    0.983    0.013    0.983      0.983    0.983      0.975    0.985     0.970

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 36  1  0  0 |  a = Alert
  0 88  0  0 |  b = Warning
  0  1 37  0 |  c = Stable
  0  0  1 14 |  d = Sustainable
```

After Addition of Features

**** 2013 ***

1. Naive Bayes

```
Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         168               94.382  %
Incorrectly Classified Instances        10                5.618  %
Kappa statistic                          0.912
Mean absolute error                      0.0334
Root mean squared error                  0.1644
Relative absolute error                 10.4325 %
Root relative squared error             41.158  %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.923    0.020    0.889      0.923    0.906      0.889    0.996     0.981     Alert
                 0.968    0.036    0.968      0.968    0.968      0.932    0.995     0.996     Warning
                 0.927    0.015    0.950      0.927    0.938      0.920    0.987     0.901     Stable
                 0.882    0.012    0.882      0.882    0.882      0.870    0.988     0.945     Sustainable
Weighted Avg.    0.944    0.026    0.944      0.944    0.944      0.917    0.993     0.967

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 24  2  0  0 |  a = Alert
  3 91  0  0 |  b = Warning
  0  1 38  2 |  c = Stable
  0  0  2 15 |  d = Sustainable
```

2. J48

```
Time taken to build model: 0.02 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         173               97.191  %
Incorrectly Classified Instances         5                2.809  %
Kappa statistic                          0.9559
Mean absolute error                      0.014
Root mean squared error                  0.1185
Relative absolute error                  4.385  %
Root relative squared error             29.6694 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.923    0.000    1.000      0.923    0.960      0.955    0.962     0.934     Alert
                 0.979    0.024    0.979      0.979    0.979      0.955    0.977     0.969     Warning
                 0.976    0.015    0.952      0.976    0.964      0.953    0.981     0.935     Stable
                 1.000    0.006    0.944      1.000    0.971      0.969    0.997     0.944     Sustainable
Weighted Avg.    0.972    0.017    0.972      0.972    0.972      0.956    0.978     0.954

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 24  2  0  0 |  a = Alert
  0 92  2  0 |  b = Warning
  0  0 40  1 |  c = Stable
  0  0  0 17 |  d = Sustainable
```

3. Random Forest

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         153               85.9551 %
Incorrectly Classified Instances        25               14.0449 %
Kappa statistic                          0.7612
Mean absolute error                      0.2097
Root mean squared error                  0.2724
Relative absolute error                 65.4689 %
Root relative squared error             68.1899 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.308    0.000    1.000      0.308    0.471      0.525    0.995     0.962     Alert
                 1.000    0.286    0.797      1.000    0.887      0.754    0.994     0.995     Warning
                 0.854    0.007    0.972      0.854    0.909      0.887    0.997     0.991     Stable
                 0.941    0.000    1.000      0.941    0.970      0.967    0.999     0.991     Sustainable
Weighted Avg.    0.860    0.153    0.886      0.860    0.839      0.772    0.996     0.989

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
  8 18  0  0 |  a = Alert
  0 94  0  0 |  b = Warning
  0  6 35  0 |  c = Stable
  0  0  1 16 |  d = Sustainable
```

4. JRip

```
Time taken to build model: 0.02 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         174               97.7528 %
Incorrectly Classified Instances         4                2.2472 %
Kappa statistic                          0.9644
Mean absolute error                      0.0112
Root mean squared error                  0.106
Relative absolute error                  3.508  %
Root relative squared error             26.5371 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.923    0.000    1.000      0.923    0.960      0.955    0.962     0.934     Alert
                 1.000    0.036    0.969      1.000    0.984      0.967    0.982     0.969     Warning
                 0.976    0.007    0.976      0.976    0.976      0.968    0.984     0.957     Stable
                 0.941    0.000    1.000      0.941    0.970      0.967    0.971     0.947     Sustainable
Weighted Avg.    0.978    0.021    0.978      0.978    0.977      0.965    0.978     0.959

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 24  2  0  0 |  a = Alert
  0 94  0  0 |  b = Warning
  0  1 40  0 |  c = Stable
  0  0  1 16 |  d = Sustainable
```

**** 2014 ****

1. Naive Bayes

```
Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         170               96.5909 %
Incorrectly Classified Instances         6                3.4091 %
Kappa statistic                          0.9466
Mean absolute error                      0.0221
Root mean squared error                  0.1353
Relative absolute error                  6.8444 %
Root relative squared error             33.7334 %
Total Number of Instances              176
Ignored Class Unknown Instances                  2

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 1.000    0.000    1.000      1.000    1.000      1.000    1.000     1.000     Alert
                 1.000    0.012    0.989      1.000    0.995      0.989    0.994     0.994     Warning
                 0.951    0.030    0.907      0.951    0.929      0.907    0.981     0.863     Stable
                 0.714    0.006    0.909      0.714    0.800      0.792    0.978     0.873     Sustainable
Weighted Avg.    0.966    0.013    0.965      0.966    0.965      0.956    0.991     0.955

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 30  0  0  0 |  a = Alert
  0 91  0  0 |  b = Warning
  0  1 39  1 |  c = Stable
  0  0  4 10 |  d = Sustainable
```

2. J48

```
Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         172               97.7273 %
Incorrectly Classified Instances         4                2.2727 %
Kappa statistic                          0.9647
Mean absolute error                      0.0114
Root mean squared error                  0.1066
Relative absolute error                  3.5194 %
Root relative squared error             26.5798 %
Total Number of Instances              176
Ignored Class Unknown Instances                  2

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 1.000    0.000    1.000      1.000    1.000      1.000    1.000     1.000     Alert
                 0.989    0.000    1.000      0.989    0.994      0.989    0.983     0.973     Warning
                 0.976    0.022    0.930      0.976    0.952      0.938    0.977     0.913     Stable
                 0.857    0.006    0.923      0.857    0.889      0.880    0.926     0.802     Sustainable
Weighted Avg.    0.977    0.006    0.978      0.977    0.977      0.970    0.980     0.950

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 30  0  0  0 |  a = Alert
  0 90  1  0 |  b = Warning
  0  0 40  1 |  c = Stable
  0  0  2 12 |  d = Sustainable
```

3. Random Forest

```
Time taken to build model: 0.08 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         159               90.3409 %
Incorrectly Classified Instances        17                9.6591 %
Kappa statistic                          0.8428
Mean absolute error                      0.2046
Root mean squared error                  0.2627
Relative absolute error                 63.3544 %
Root relative squared error             65.5096 %
Total Number of Instances              176
Ignored Class Unknown Instances                  2

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.633    0.000    1.000      0.633    0.776      0.767    0.998     0.992     Alert
                 1.000    0.153    0.875      1.000    0.933      0.861    0.999     0.999     Warning
                 0.951    0.030    0.907      0.951    0.929      0.907    0.999     0.998     Stable
                 0.714    0.000    1.000      0.714    0.833      0.835    1.000     1.000     Sustainable
Weighted Avg.    0.903    0.086    0.914      0.903    0.897      0.854    0.999     0.998

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 19 11  0  0 |  a = Alert
  0 91  0  0 |  b = Warning
  0  2 39  0 |  c = Stable
  0  0  4 10 |  d = Sustainable
```

4. JRip

```
Time taken to build model: 0.01 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         173               98.2955 %
Incorrectly Classified Instances         3                1.7045 %
Kappa statistic                          0.9733
Mean absolute error                      0.0088
Root mean squared error                  0.0923
Relative absolute error                  2.7349 %
Root relative squared error             23.0238 %
Total Number of Instances              176
Ignored Class Unknown Instances                  2

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.967    0.000    1.000      0.967    0.983      0.980    0.983     0.972     Alert
                 1.000    0.024    0.978      1.000    0.989      0.977    0.975     0.954     Warning
                 0.976    0.007    0.976      0.976    0.976      0.968    0.983     0.957     Stable
                 0.929    0.000    1.000      0.929    0.963      0.961    0.964     0.934     Sustainable
Weighted Avg.    0.983    0.014    0.983      0.983    0.983      0.974    0.977     0.956

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 29  1  0  0 |  a = Alert
  0 91  0  0 |  b = Warning
  0  1 40  0 |  c = Stable
  0  0  1 13 |  d = Sustainable
```

**** 2015 ****

1. Naive Bayes

```
Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         166               93.2584 %
Incorrectly Classified Instances        12                6.7416 %
Kappa statistic                          0.8967
Mean absolute error                      0.0374
Root mean squared error                  0.1755
Relative absolute error                 11.3532 %
Root relative squared error             43.2943 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.938    0.014    0.938      0.938    0.938      0.924    0.992     0.975     Alert
                 0.978    0.056    0.946      0.978    0.961      0.922    0.989     0.987     Warning
                 0.854    0.015    0.946      0.854    0.897      0.871    0.984     0.895     Stable
                 0.875    0.019    0.824      0.875    0.848      0.833    0.988     0.917     Sustainable
Weighted Avg.    0.933    0.036    0.933      0.933    0.932      0.902    0.988     0.957

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 30  2  0  0 |  a = Alert
  2 87  0  0 |  b = Warning
  0  3 35  3 |  c = Stable
  0  0  2 14 |  d = Sustainable
```

2. J48

```
Time taken to build model: 0 seconds

=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9743
Mean absolute error                      0.0084
Root mean squared error                  0.0918
Relative absolute error                  2.5574 %
Root relative squared error             22.6501 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.969    0.000    1.000      0.969    0.984      0.981    0.984     0.974     Alert
                 0.989    0.011    0.989      0.989    0.989      0.978    0.989     0.983     Warning
                 0.976    0.007    0.976      0.976    0.976      0.968    0.984     0.957     Stable
                 1.000    0.006    0.941      1.000    0.970      0.967    0.997     0.941     Sustainable
Weighted Avg.    0.983    0.008    0.983      0.983    0.983      0.975    0.988     0.972

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 31  1  0  0 |  a = Alert
  0 88  1  0 |  b = Warning
  0  0 40  1 |  c = Stable
  0  0  0 16 |  d = Sustainable
```

3. Random Forest

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         150               84.2697 %
Incorrectly Classified Instances        28               15.7303 %
Kappa statistic                          0.7427
Mean absolute error                      0.2212
Root mean squared error                  0.2828
Relative absolute error                 67.1438 %
Root relative squared error             69.7663 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.469    0.000    1.000      0.469    0.638      0.648    1.000     1.000     Alert
                 1.000    0.281    0.781      1.000    0.877      0.749    0.998     0.998     Warning
                 0.805    0.022    0.917      0.805    0.857      0.821    0.994     0.980     Stable
                 0.813    0.000    1.000      0.813    0.897      0.893    0.998     0.986     Sustainable
Weighted Avg.    0.843    0.145    0.871      0.843    0.831      0.760    0.997     0.993

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 15 17  0  0 |  a = Alert
  0 89  0  0 |  b = Warning
  0  8 33  0 |  c = Stable
  0  0  3 13 |  d = Sustainable
```

4. JRip

```
=== Stratified cross-validation ===
=== Summary ===

Correctly Classified Instances         175               98.3146 %
Incorrectly Classified Instances         3                1.6854 %
Kappa statistic                          0.9742
Mean absolute error                      0.0091
Root mean squared error                  0.0919
Relative absolute error                  2.7469 %
Root relative squared error             22.6669 %
Total Number of Instances              178

=== Detailed Accuracy By Class ===

                 TP Rate  FP Rate  Precision  Recall   F-Measure  MCC      ROC Area  PRC Area  Class
                 0.969    0.000    1.000      0.969    0.984      0.981    0.984     0.974     Alert
                 1.000    0.022    0.978      1.000    0.989      0.978    0.988     0.976     Warning
                 0.976    0.007    0.976      0.976    0.976      0.968    0.983     0.955     Stable
                 0.938    0.000    1.000      0.938    0.968      0.965    0.968     0.943     Sustainable
Weighted Avg.    0.983    0.013    0.983      0.983    0.983      0.975    0.984     0.968

=== Confusion Matrix ===

  a  b  c  d   <-- classified as
 31  1  0  0 |  a = Alert
  0 89  0  0 |  b = Warning
  0  1 40  0 |  c = Stable
  0  0  1 15 |  d = Sustainable
```

Analysis: J48 and JRip provide consistently high classification results. Naive Bayes and Random Forests do not consistently provide high classification results.

6. **Report and analysis of action rule mining results.**

Report

Using LISp-Miner we generate action rules to assess how a country can transfer from the FSI state of Alert to Stable.

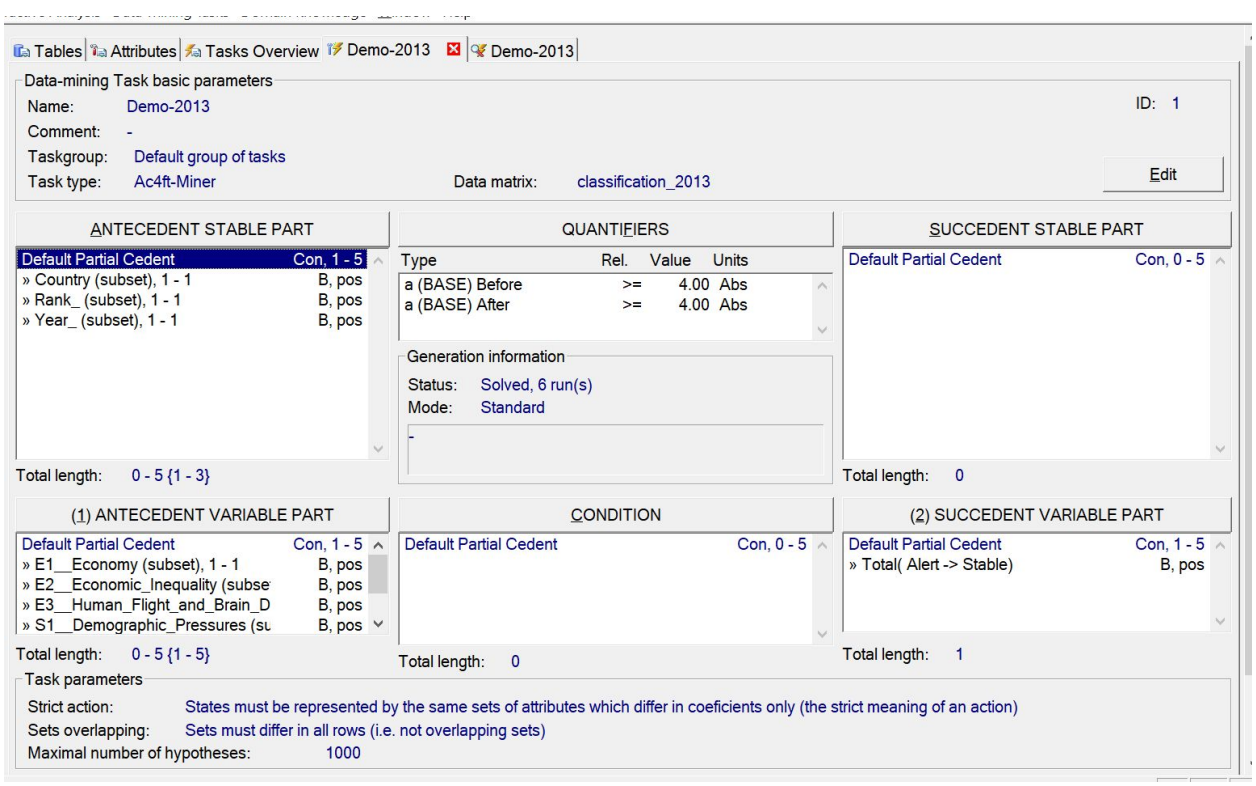
Decision Attributes: Alert, Warning, Sustainable, Stable
Stable Attributes: Country, Rank, Year
Flexible Attributes: E1: Economy, E2: Economic Inequality, E3: Human Flight and Brain Drain, S1: Demographic Pressures, S2: Refugees and IDPs

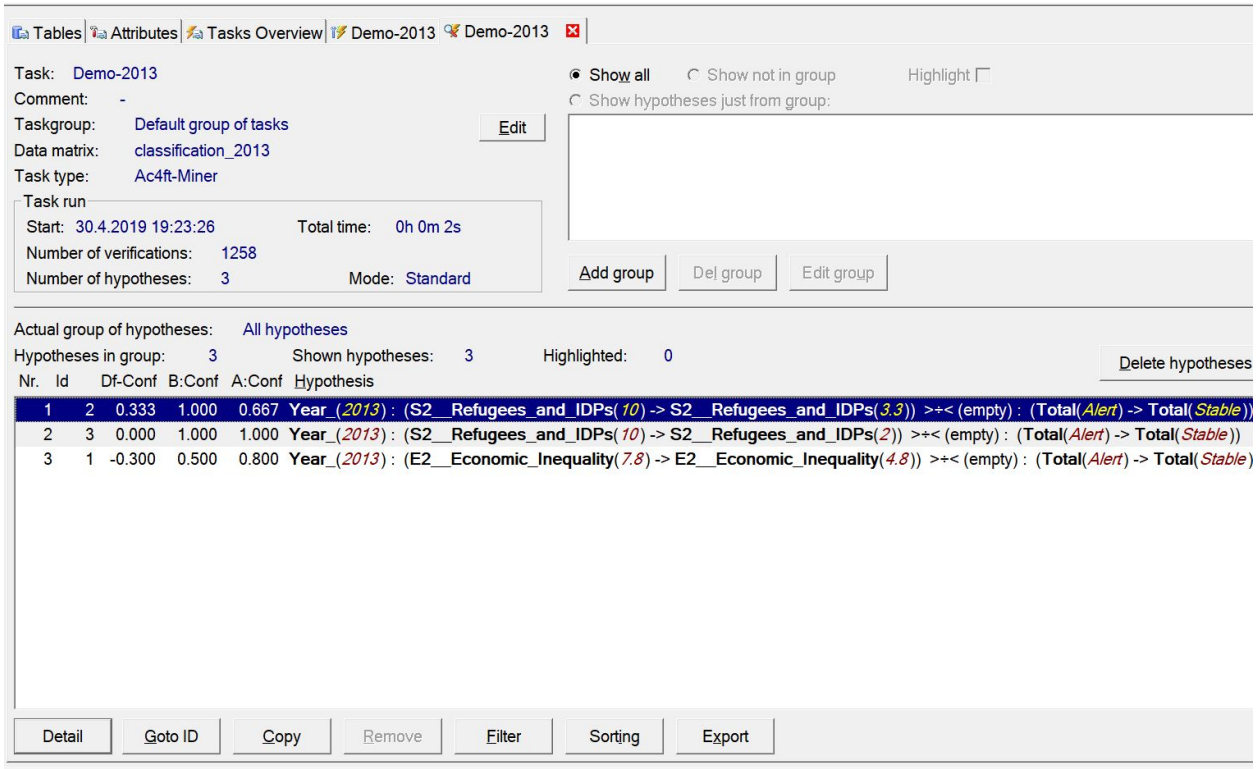
Hypothesis Setup-
Antecedent Stable: Country, Rank, Year
Antecedent Variable: E1: Economy, E2: Economic Inequality, E3: Human Flight and Brain Drain, S1: Demographic Pressures, S2: Refugees and IDPs.
Succedent Variable: Total
Quantifiers: a (BASE) Before >= 3.00 Abs
a (BASE) After >= 3.00 Abs

Action Rules

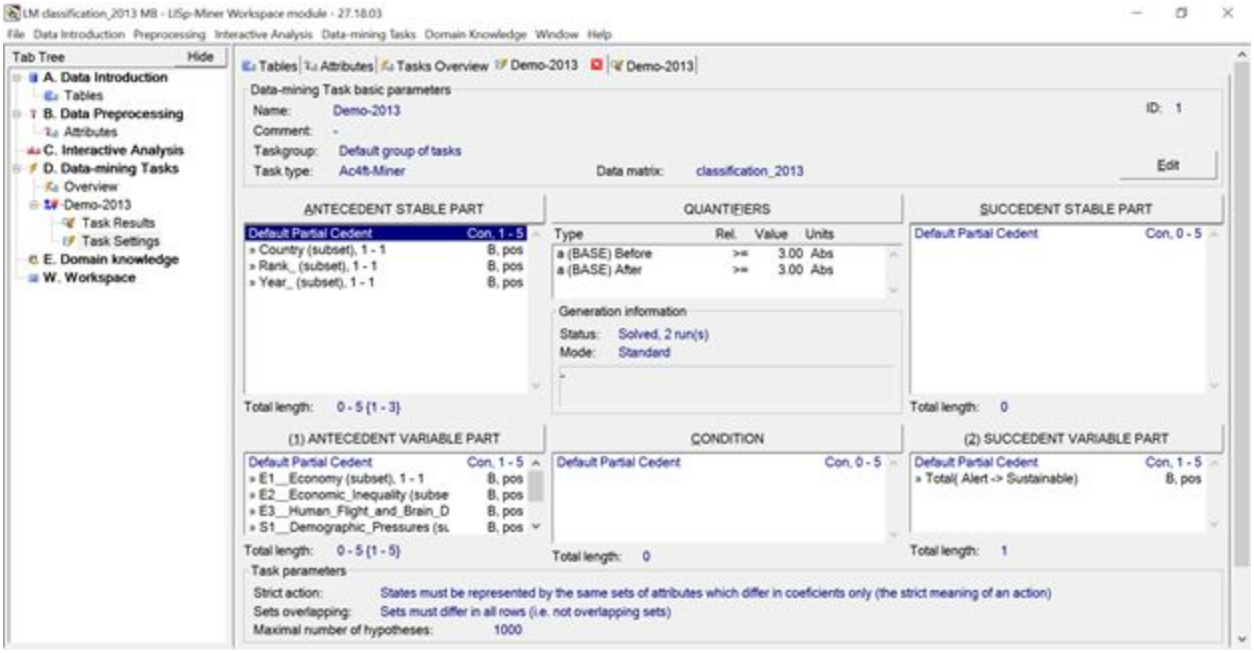
2013

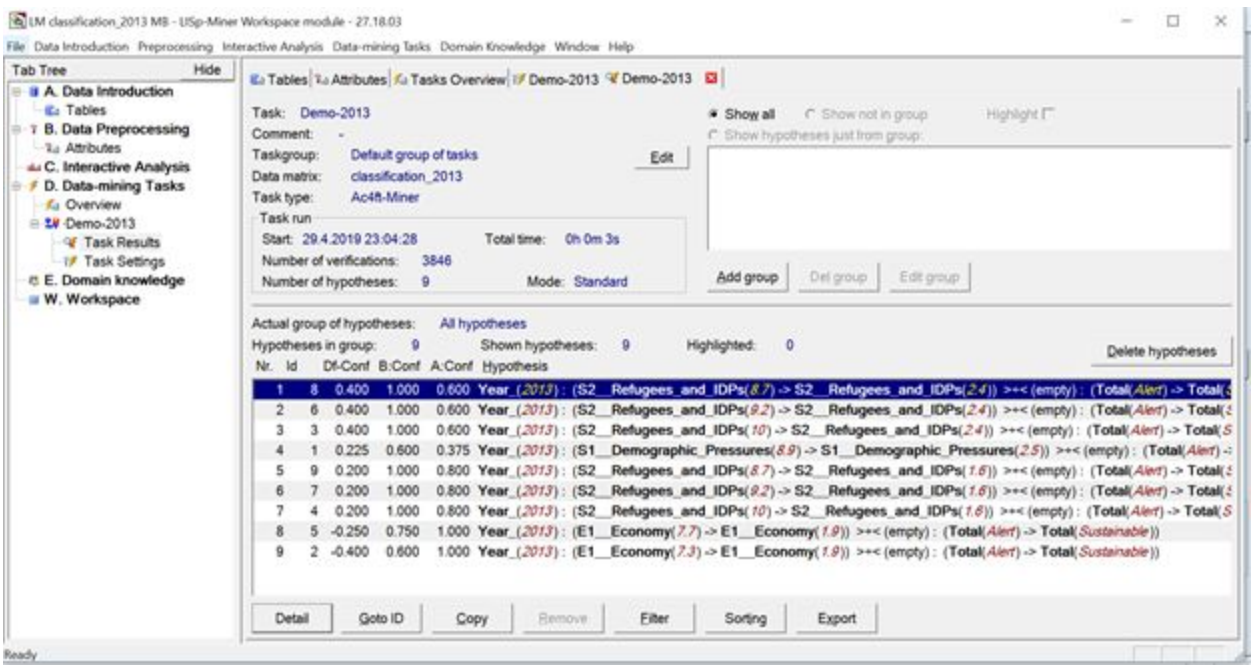
**** 2013(Alert -> Stable) ****





**** 2013 (Alert -> Sustainable) ****





**** 2013 (Alert -> Warning) ****

Tables | Attributes | Tasks Overview | Demo-2013 | Demo-2013

Data-mining Task basic parameters

Name: Demo-2013 ID: 1
Comment: -
Taskgroup: Default group of tasks
Task type: Ac4ft-Miner Data matrix: classification_2013 Edit

ANTECEDENT STABLE PART

Default Partial Cedent	Con, 1 - 5
» Country (subset), 1 - 1	B, pos
» Rank_ (subset), 1 - 1	B, pos
» Year_ (subset), 1 - 1	B, pos

Total length: 0 - 5 {1 - 3}

QUANTIFIERS

Type	Rel.	Value	Units
a (BASE) Before	>=	4.00	Abs
a (BASE) After	>=	4.00	Abs

Generation information
Status: Solved, 9 run(s)
Mode: Standard

SUCCEDENT STABLE PART

Default Partial Cedent	Con, 0 - 5

Total length: 0

(1) ANTECEDENT VARIABLE PART

Default Partial Cedent	Con, 1 - 5
» E1__Economy (subset), 1 - 1	B, pos
» E2__Economic_Inequality (subse	B, pos
» E3__Human_Flight_and_Brain_D	B, pos
» S1__Demographic_Pressures (su	B, pos

Total length: 0 - 5 {1 - 5}

CONDITION

Default Partial Cedent	Con, 0 - 5

Total length: 0

(2) SUCCEDENT VARIABLE PART

Default Partial Cedent	Con, 1 - 5
» Total(Alert -> Warning)	B, pos

Total length: 1

Task parameters

Strict action: States must be represented by the same sets of attributes which differ in coeficients only (the strict meaning of an action)
Sets overlapping: Sets must differ in all rows (i.e. not overlapping sets)
Maximal number of hypotheses: 1000

Tab Tree Hide
- A. Data Introduction
  - Tables
- B. Data Preprocessing
  - Attributes
- C. Interactive Analysis
- D. Data-mining Tasks
  - Overview
  - Demo-2013
    - Task Results
    - Task Settings
- E. Domain knowledge
- W. Workspace

Tables | Attributes | Tasks Overview | Demo-2013 | Demo-2013

Task: Demo-2013
Comment: -
Taskgroup: Default group of tasks Edit
Data matrix: classification_2013
Task type: Ac4ft-Miner

Task run
Start: 30.4.2019 21:15:00 Total time: 0h 0m 1s
Number of verifications: 1258
Number of hypotheses: 15 Mode: Standard

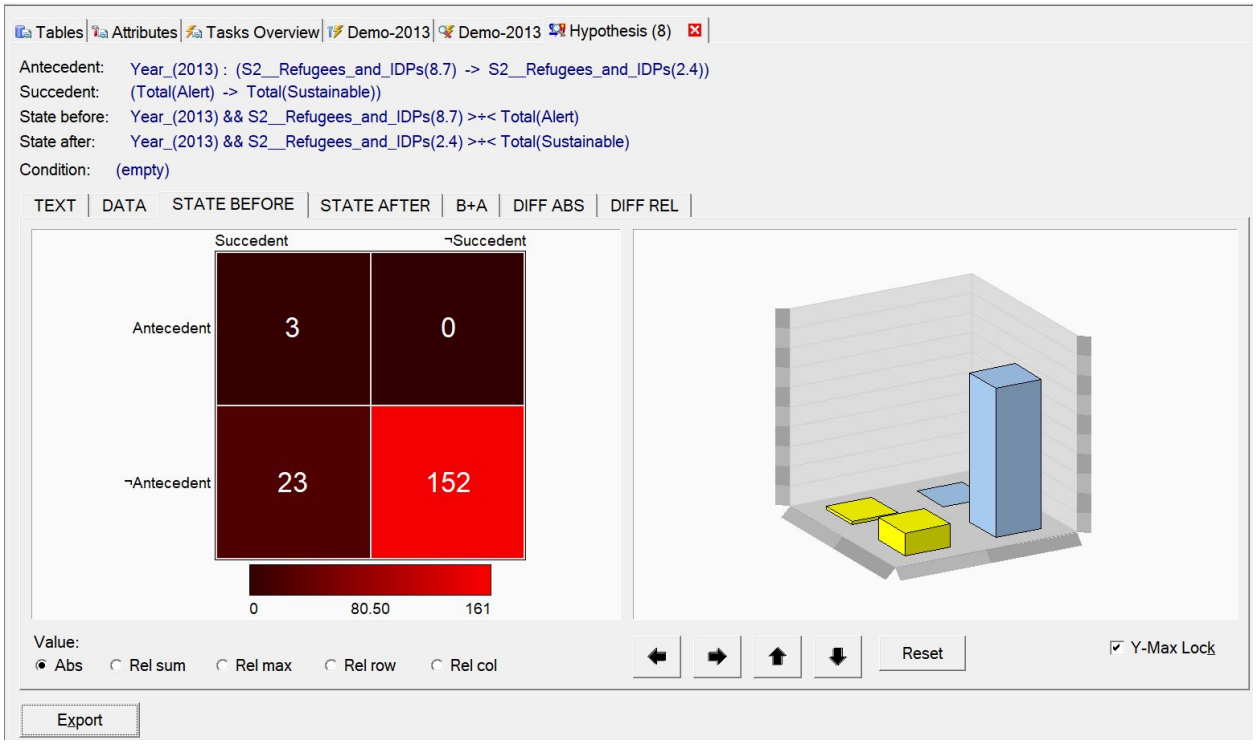
Show all | Show not in group | Highlight
Show hypotheses just from group:
Add group | Del group | Edit group

Actual group of hypotheses: All hypotheses
Hypotheses in group: 15 Shown hypotheses: 15 Highlighted: 0
Delete hypotheses

Nr.	Id	Df-Conf	B:Conf	A:Conf	Hypothesis
1	12	0.000	1.000	1.000	Year_(2013) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(7.4)) >+< (empty) : (Total(Alert) -> Total(Warning
2	13	0.000	1.000	1.000	Year_(2013) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(6.5)) >+< (empty) : (Total(Alert) -> Total(Warning
3	14	0.000	1.000	1.000	Year_(2013) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(5.3)) >+< (empty) : (Total(Alert) -> Total(Warning
4	15	0.000	1.000	1.000	Year_(2013) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(4.9)) >+< (empty) : (Total(Alert) -> Total(Warning
5	4	-0.167	0.500	0.667	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(5.9)) >+< (empty) : (Total(Alert) -> Total(Warnir
6	1	-0.214	0.500	0.714	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(8.1)) >+< (empty) : (Total(Alert) -> Total(Warnir
7	7	-0.300	0.500	0.800	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(6.5)) >+< (empty) : (Total(Alert) -> Total(Warnir
8	2	-0.357	0.500	0.857	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(8)) >+< (empty) : (Total(Alert) -> Total(Warning
9	3	-0.500	0.500	1.000	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(6.9)) >+< (empty) : (Total(Alert) -> Total(Warnir
10	5	-0.500	0.500	1.000	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(7)) >+< (empty) : (Total(Alert) -> Total(Warning
11	6	-0.500	0.500	1.000	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(6.8)) >+< (empty) : (Total(Alert) -> Total(Warnir
12	8	-0.500	0.500	1.000	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(6.2)) >+< (empty) : (Total(Alert) -> Total(Warnir
13	9	-0.500	0.500	1.000	Year_(2013) : (E2__Economic_Inequality(7.8) -> E2__Economic_Inequality(7.5)) >+< (empty) : (Total(Alert) -> Total(Warnir

Detail | Goto ID | Copy | Remove | Filter | Sorting | Export

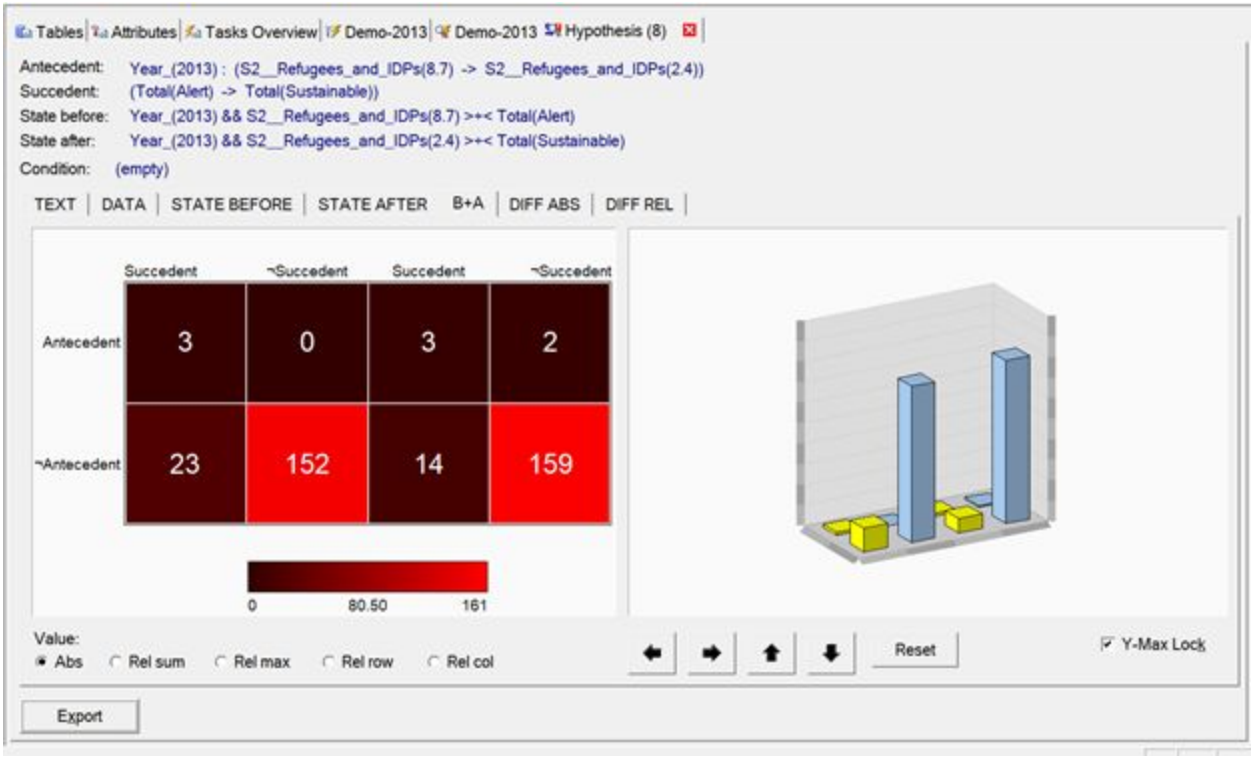
State Before:


Tables
Attributes
Tasks Overview
Demo-2013
Demo-2013
Hypothesis (8)
Antecedent: Year_(2013) : (S2__Refugees_and_IDPs(8.7) -> S2__Refugees_and_IDPs(2.4))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2013) && S2__Refugees_and_IDPs(8.7) >+< Total(Alert)
State after: Year_(2013) && S2__Refugees_and_IDPs(2.4) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
3
0
23
152
0
80.50
161
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

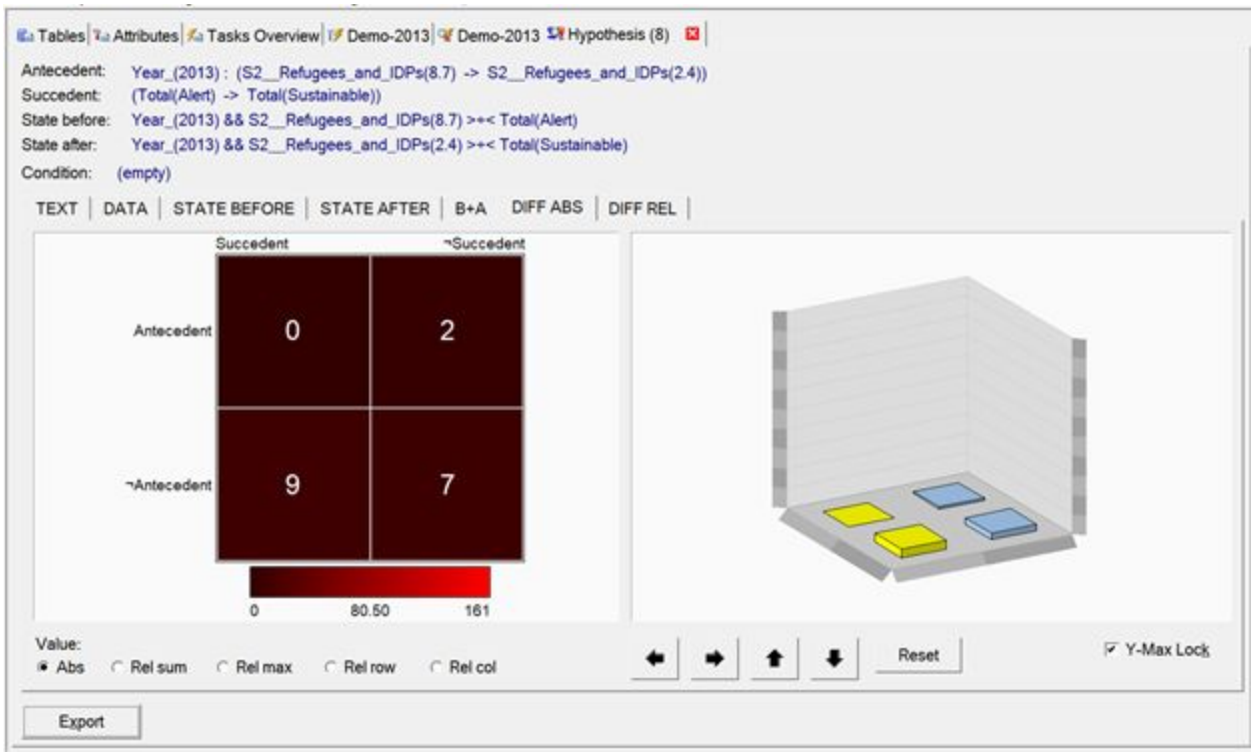
State After:

Tables
Attributes
Tasks Overview
Demo-2013
Demo-2013
Hypothesis (8)
Antecedent: Year_(2013) : (S2__Refugees_and_IDPs(8.7) -> S2__Refugees_and_IDPs(2.4))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2013) && S2__Refugees_and_IDPs(8.7) >+< Total(Alert)
State after: Year_(2013) && S2__Refugees_and_IDPs(2.4) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
3
2
14
159
0
80.50
161
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

B+A


Tables
Attributes
Tasks Overview
Demo-2013
Demo-2013
Hypothesis (8)
Antecedent: Year_(2013) : (S2__Refugees_and_IDPs(8.7) -> S2__Refugees_and_IDPs(2.4))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2013) && S2__Refugees_and_IDPs(8.7) >+< Total(Alert)
State after: Year_(2013) && S2__Refugees_and_IDPs(2.4) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Succedent
¬Succedent
Antecedent
3
0
3
2
¬Antecedent
23
152
14
159
0
80.50
161
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

DIFF ABS


Tables
Attributes
Tasks Overview
Demo-2013
Demo-2013
Hypothesis (8)
Antecedent: Year_(2013) : (S2__Refugees_and_IDPs(8.7) -> S2__Refugees_and_IDPs(2.4))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2013) && S2__Refugees_and_IDPs(8.7) >+< Total(Alert)
State after: Year_(2013) && S2__Refugees_and_IDPs(2.4) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
0
2
9
7
0
80.50
161
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

DIFF REL

LM classification_2013 MB - LISp-Miner Workspace module - 27.18.03
File
Data Introduction
Preprocessing
Interactive Analysis
Data-mining Tasks
Domain Knowledge
Window
Help
Tab Tree
Hide
A. Data Introduction
Tables
B. Data Preprocessing
Attributes
C. Interactive Analysis
D. Data-mining Tasks
Overview
Demo-2013
Task Results
Task Settings
Hypothesis (8)
E. Domain knowledge
W. Workspace
Tables
Attributes
Tasks Overview
Demo-2013
Demo-2013
Hypothesis (8)
Antecedent: Year_(2013) : (S2__Refugees_and_IDPs(8.7) -> S2__Refugees_and_IDPs(2.4))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2013) && S2__Refugees_and_IDPs(8.7) >+< Total(Alert)
State after: Year_(2013) && S2__Refugees_and_IDPs(2.4) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
0
1
5
4
0
2.50
5
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

Analysis:

The action rule mining provided the following results:

Year_(2013) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(3.3)) >˜< (Total(Alert) -> Total(Stable))

For the status to transition from Alert to Stable: The highest confidence rule generated recommends reducing the Refugee and IDP score to be dropped to 3.3.

Year_(2013) : (S2__Refugees_and_IDPs(8.7) -> S2__Refugees_and_IDPs(2.4)) >˜< (Total(Alert) -> Total(Sustainable))

For the status to transition from Alert to Sustainable: The highest confidence rule generated recommends reducing the Refugee and IDP score to be dropped to 2.7.

Year_(2013) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(7.4)) >˜< (Total(Alert) -> Total(Warning))

For the status to transition from Alert to Warning: The highest confidence rule generated recommends reducing the Refugee and IDP score to be dropped to 7.4.

2014

**** 2014(Alert -> Stable) ****

Tables | Attributes | Tasks Overview | Demo-2014 | Demo-2014

Data-mining Task basic parameters

Name: Demo-2014 ID: 1
Comment: -
Taskgroup: Default group of tasks
Task type: Ac4ft-Miner Data matrix: classification_2014 Edit

ANTECEDENT STABLE PART

Default Partial Cedent	Con, 1 - 5
» Country (subset), 1 - 1	B, pos
» Rank_ (subset), 1 - 1	B, pos
» Year_ (subset), 1 - 1	B, pos

Total length: 0 - 5 {1 - 3}

QUANTIFIERS

Type	Rel.	Value	Units
a (BASE) Before	>=	4.00	Abs
a (BASE) After	>=	4.00	Abs

Generation information
Status: Solved, 12 run(s)
Mode: Standard
-

SUCCEDENT STABLE PART

Default Partial Cedent	Con, 0 - 5

Total length: 0

(1) ANTECEDENT VARIABLE PART

Default Partial Cedent	Con, 1 - 5
» E1__Economy (subset), 1 - 1	B, pos
» E2__Economic_Inequality (subse	B, pos
» E3__Human_Flight_and_Brain_D	B, pos
» S1__Demographic_Pressures (su	B, pos

Total length: 0 - 5 {1 - 5}

CONDITION

Default Partial Cedent	Con, 0 - 5

Total length: 0

(2) SUCCEDENT VARIABLE PART

Default Partial Cedent	Con, 1 - 5
» Total(Alert -> Stable)	B, pos

Total length: 1

Task parameters
Strict action: States must be represented by the same sets of attributes which differ in coeficients only (the strict meaning of an action)
Sets overlapping: Sets must differ in all rows (i.e. not overlapping sets)
Maximal number of hypotheses: 1000

Tables | Attributes | Tasks Overview | Demo-2014 | Demo-2014

Task: Demo-2014
Comment: -
Taskgroup: Default group of tasks
Data matrix: classification_2014
Task type: Ac4ft-Miner
Edit

Task run
Start: 30.4.2019 19:38:27 Total time: 0h 0m 2s
Number of verifications: 1432
Number of hypotheses: 5 Mode: Standard

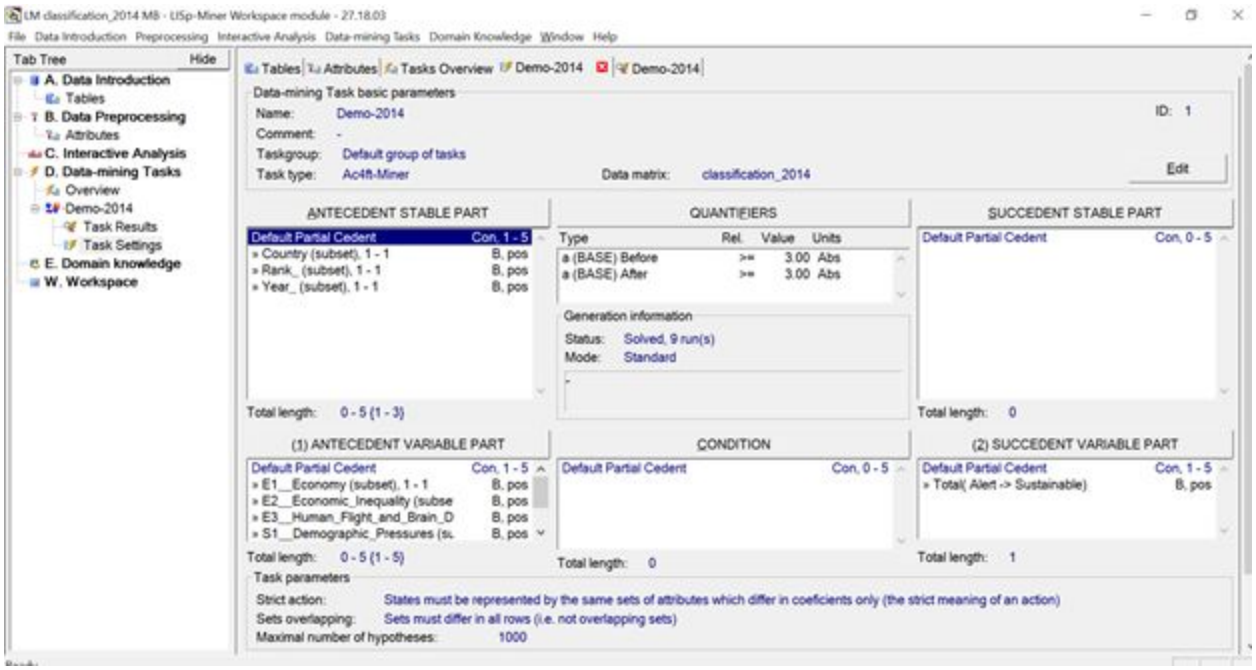
Show all | Show not in group | Highlight
Show hypotheses just from group:
Add group | Del group | Edit group

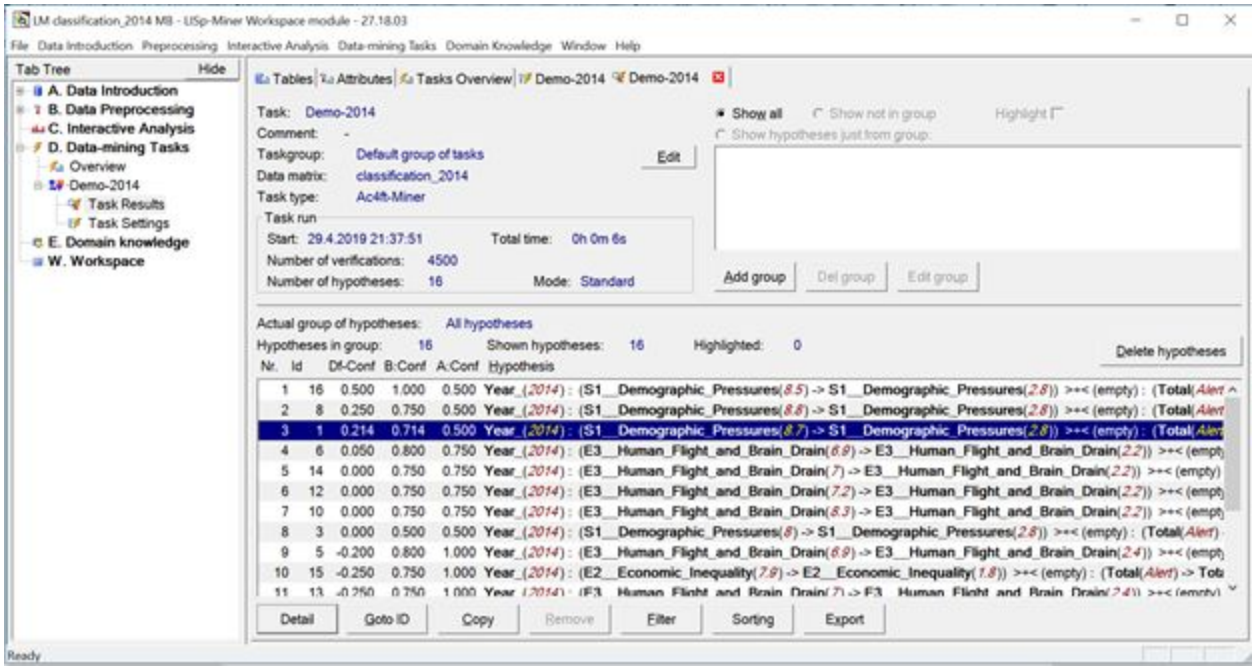
Actual group of hypotheses: All hypotheses
Hypotheses in group: 5 Shown hypotheses: 5 Highlighted: 0
Delete hypotheses

Nr.	Id	Df-Conf	B:Conf	A:Conf	Hypothesis
1	4	0.167	1.000	0.833	Year_(2014) : (S2__Refugees_and_IDPs(8.2) -> S2__Refugees_and_IDPs(2.3)) >+< (empty) : (Total(Alert) -> Total(Stable))
2	2	0.167	1.000	0.833	Year_(2014) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(2.3)) >+< (empty) : (Total(Alert) -> Total(Stable))
3	5	0.000	1.000	1.000	Year_(2014) : (S2__Refugees_and_IDPs(8.2) -> S2__Refugees_and_IDPs(2.5)) >+< (empty) : (Total(Alert) -> Total(Stable))
4	3	0.000	1.000	1.000	Year_(2014) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(2.5)) >+< (empty) : (Total(Alert) -> Total(Stable))
5	1	-0.286	0.714	1.000	Year_(2014) : (S1__Demographic_Pressures(8.7) -> S1__Demographic_Pressures(3.6)) >+< (empty) : (Total(Alert) -> Total(

Detail | Goto ID | Copy | Remove | Filter | Sorting | Export

**** 2014(Alert -> Sustainable) ****





**** 2014(Alert -> Warning) ****

Tables | Attributes | Tasks Overview | Demo-2014 | Demo-2014

Task: Demo-2014
Comment: -
Taskgroup: Default group of tasks
Data matrix: classification_2014
Task type: Ac4ft-Miner

Edit

Task run
Start: 30.4.2019 21:20:51 Total time: 0h 0m 1s
Number of verifications: 1432
Number of hypotheses: 21 Mode: Standard

Show all | Show not in group | Highlight
Show hypotheses just from group:

Add group | Del group | Edit group

Actual group of hypotheses: All hypotheses
Hypotheses in group: 21 Shown hypotheses: 21 Highlighted: 0

Delete hypotheses

Nr.	Id	Df-Conf	B:Conf	A:Conf	Hypothesis
10	16	0.000	1.000	1.000	Year_(2014) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(4.2)) >+< (empty) : (Total(Alert) -> Total(Warning
11	8	0.000	0.800	0.800	Year_(2014) : (E3__Human_Flight_and_Brain_Drain(6.9) -> E3__Human_Flight_and_Brain_Drain(7.3)) >+< (empty) : (Tota
12	10	0.000	0.800	0.800	Year_(2014) : (E3__Human_Flight_and_Brain_Drain(6.9) -> E3__Human_Flight_and_Brain_Drain(6)) >+< (empty) : (Total(
13	6	-0.033	0.800	0.833	Year_(2014) : (E3__Human_Flight_and_Brain_Drain(6.9) -> E3__Human_Flight_and_Brain_Drain(6.6)) >+< (empty) : (Tota
14	1	-0.119	0.714	0.833	Year_(2014) : (S1__Demographic_Pressures(8.7) -> S1__Demographic_Pressures(5.4)) >+< (empty) : (Total(Alert) -> Tota
15	7	-0.200	0.800	1.000	Year_(2014) : (E3__Human_Flight_and_Brain_Drain(6.9) -> E3__Human_Flight_and_Brain_Drain(5.5)) >+< (empty) : (Tota
16	9	-0.200	0.800	1.000	Year_(2014) : (E3__Human_Flight_and_Brain_Drain(6.9) -> E3__Human_Flight_and_Brain_Drain(7.1)) >+< (empty) : (Tota
17	11	-0.200	0.800	1.000	Year_(2014) : (E3__Human_Flight_and_Brain_Drain(6.9) -> E3__Human_Flight_and_Brain_Drain(4.8)) >+< (empty) : (Tota
18	2	-0.286	0.714	1.000	Year_(2014) : (S1__Demographic_Pressures(8.7) -> S1__Demographic_Pressures(8.1)) >+< (empty) : (Total(Alert) -> Tota
19	3	-0.286	0.714	1.000	Year_(2014) : (S1__Demographic_Pressures(8.7) -> S1__Demographic_Pressures(5.9)) >+< (empty) : (Total(Alert) -> Tota
20	4	-0.286	0.714	1.000	Year_(2014) : (S1__Demographic_Pressures(8.7) -> S1__Demographic_Pressures(5.7)) >+< (empty) : (Total(Alert) -> Tota
21	5	-0.286	0.714	1.000	Year_(2014) : (S1__Demographic_Pressures(8.7) -> S1__Demographic_Pressures(5.5)) >+< (empty) : (Total(Alert) -> Tota

Detail | Goto ID | Copy | Remove | Filter | Sorting | Export

Tables | Attributes | Tasks Overview | Demo-2014 | Demo-2014

Data-mining Task basic parameters

Name: Demo-2014 ID: 1

Comment: -

Taskgroup: Default group of tasks

Task type: Ac4ft-Miner Data matrix: classification_2014 Edit

ANTECEDENT STABLE PART	
Default Partial Cedent	Con, 1 - 5
» Country (subset), 1 - 1	B, pos
» Rank_ (subset), 1 - 1	B, pos
» Year_ (subset), 1 - 1	B, pos

Total length: 0 - 5 {1 - 3}

QUANTIFIERS

Type	Rel.	Value	Units
a (BASE) Before	>=	4.00	Abs
a (BASE) After	>=	4.00	Abs

Generation information

Status: Solved, 15 run(s)

Mode: Standard

-

SUCCEDENT STABLE PART	
Default Partial Cedent	Con, 0 - 5

Total length: 0

(1) ANTECEDENT VARIABLE PART	
Default Partial Cedent	Con, 1 - 5
» E1__Economy (subset), 1 - 1	B, pos
» E2__Economic_Inequality (subse	B, pos
» E3__Human_Flight_and_Brain_D	B, pos
» S1__Demographic_Pressures (su	B, pos

Total length: 0 - 5 {1 - 5}

CONDITION	
Default Partial Cedent	Con, 0 - 5

Total length: 0

(2) SUCCEDENT VARIABLE PART	
Default Partial Cedent	Con, 1 - 5
» Total(Alert -> Warning)	B, pos

Total length: 1

Task parameters

Strict action: States must be represented by the same sets of attributes which differ in coeficients only (the strict meaning of an action)

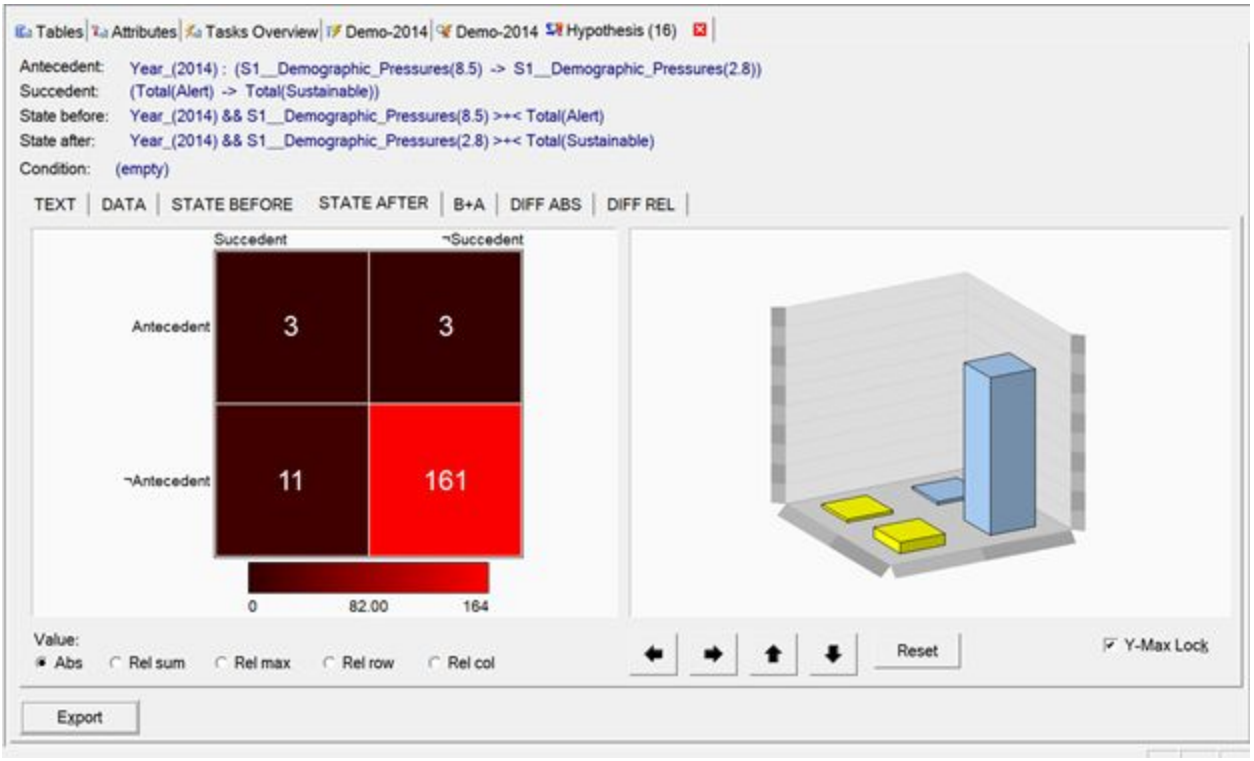
Sets overlapping: Sets must differ in all rows (i.e. not overlapping sets)

Maximal number of hypotheses: 1000

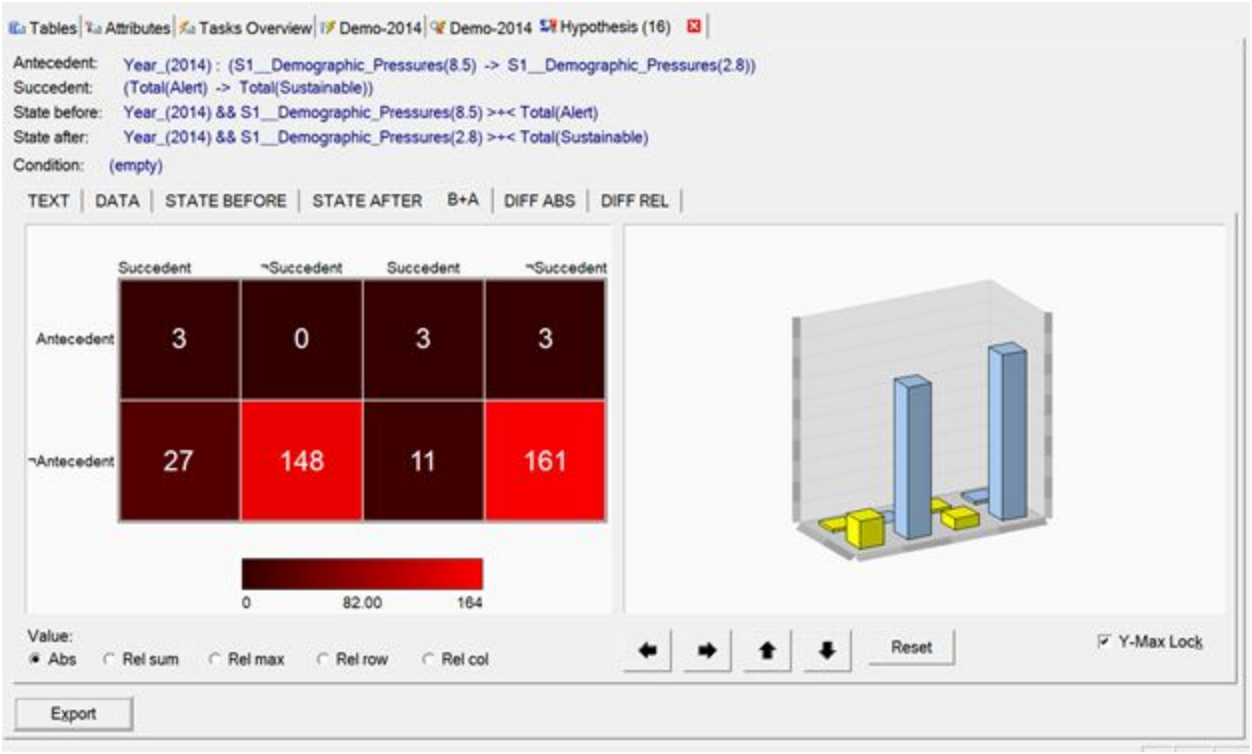
State Before

Tables
Attributes
Tasks Overview
Demo-2014
Demo-2014
Hypothesis (16)
Antecedent: Year_(2014) : (S1__Demographic_Pressures(8.5) -> S1__Demographic_Pressures(2.8))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2014) && S1__Demographic_Pressures(8.5) >+< Total(Alert)
State after: Year_(2014) && S1__Demographic_Pressures(2.8) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
3
0
27
148
0
82.00
164
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

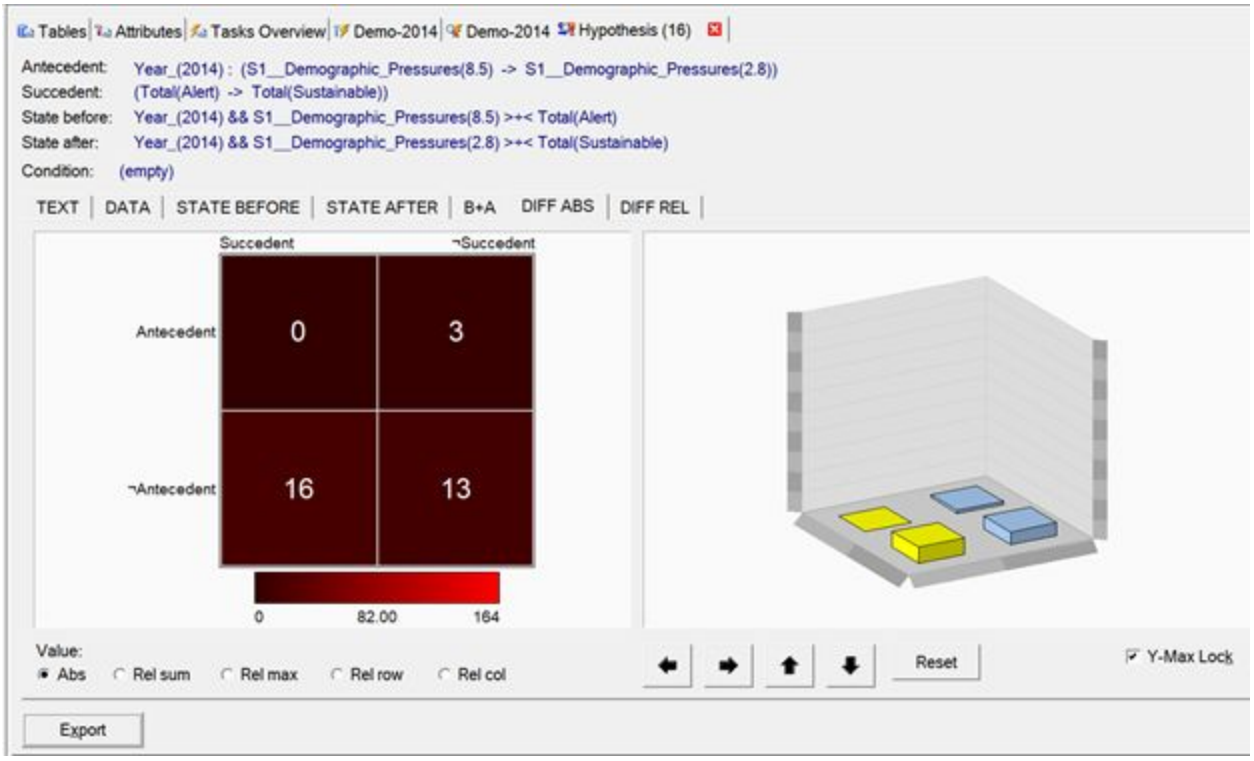
State After


Tables
Attributes
Tasks Overview
Demo-2014
Demo-2014
Hypothesis (16)
Antecedent: Year_(2014) : (S1__Demographic_Pressures(8.5) -> S1__Demographic_Pressures(2.8))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2014) && S1__Demographic_Pressures(8.5) >+< Total(Alert)
State after: Year_(2014) && S1__Demographic_Pressures(2.8) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
3
3
11
161
0
82.00
164
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

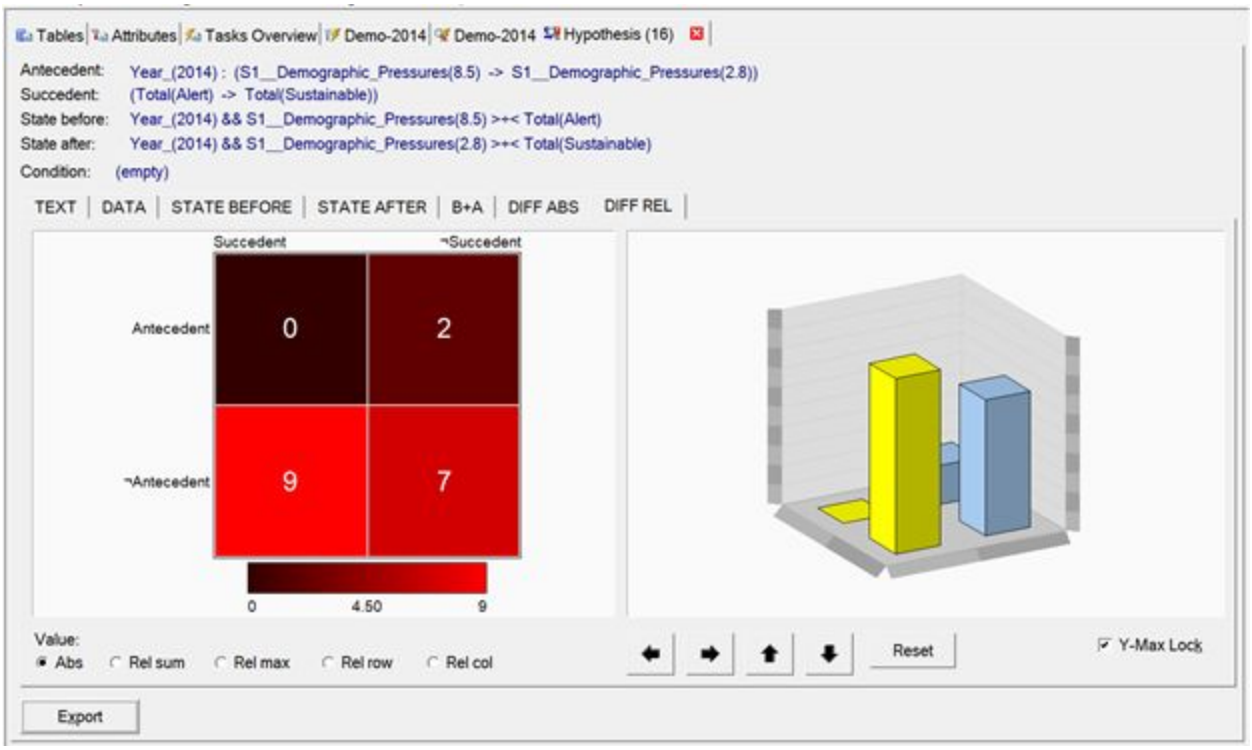
B+A


Tables
Attributes
Tasks Overview
Demo-2014
Demo-2014
Hypothesis (16)
Antecedent: Year_(2014) : (S1__Demographic_Pressures(8.5) -> S1__Demographic_Pressures(2.8))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2014) && S1__Demographic_Pressures(8.5) >+< Total(Alert)
State after: Year_(2014) && S1__Demographic_Pressures(2.8) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Succedent
¬Succedent
Antecedent
3
0
3
3
¬Antecedent
27
148
11
161
0
82.00
164
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

DIFF ABS


Tables
Attributes
Tasks Overview
Demo-2014
Demo-2014
Hypothesis (16)
Antecedent: Year_(2014) : (S1__Demographic_Pressures(8.5) -> S1__Demographic_Pressures(2.8))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2014) && S1__Demographic_Pressures(8.5) >+< Total(Alert)
State after: Year_(2014) && S1__Demographic_Pressures(2.8) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
0
3
16
13
0
82.00
164
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

DIFF REL



Analysis:

The action rule mining provided the following results:

Year_(2014) : (S2__Refugees_and_IDPs(8.3) -> S2__Refugees_and_IDPs(2.3)) >˜< (Total(Alert) -> Total(Stable))

For the status to transition from Alert to Stable: The highest confidence rule generated recommends reducing the Refugee and IDP score to be dropped to 2.3.

Year_(2014) : (S1__Demographic_Pressures(8.5) -> S1__Demographic_Pressures(2.8)) >˜< (Total(Alert) -> Total(Sustainable))

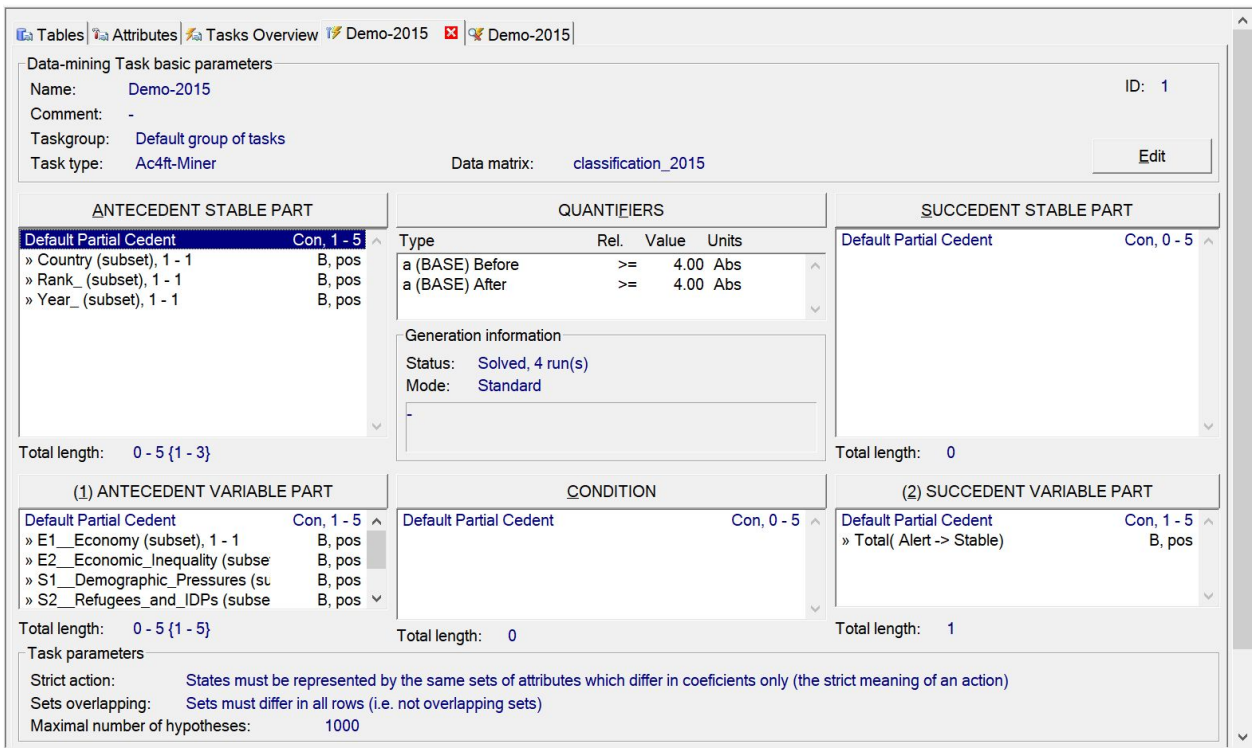
For the status to transition from Alert to Sustainable: The highest confidence rule generated recommends reducing the Demographic Pressure score to be dropped to 2.8.

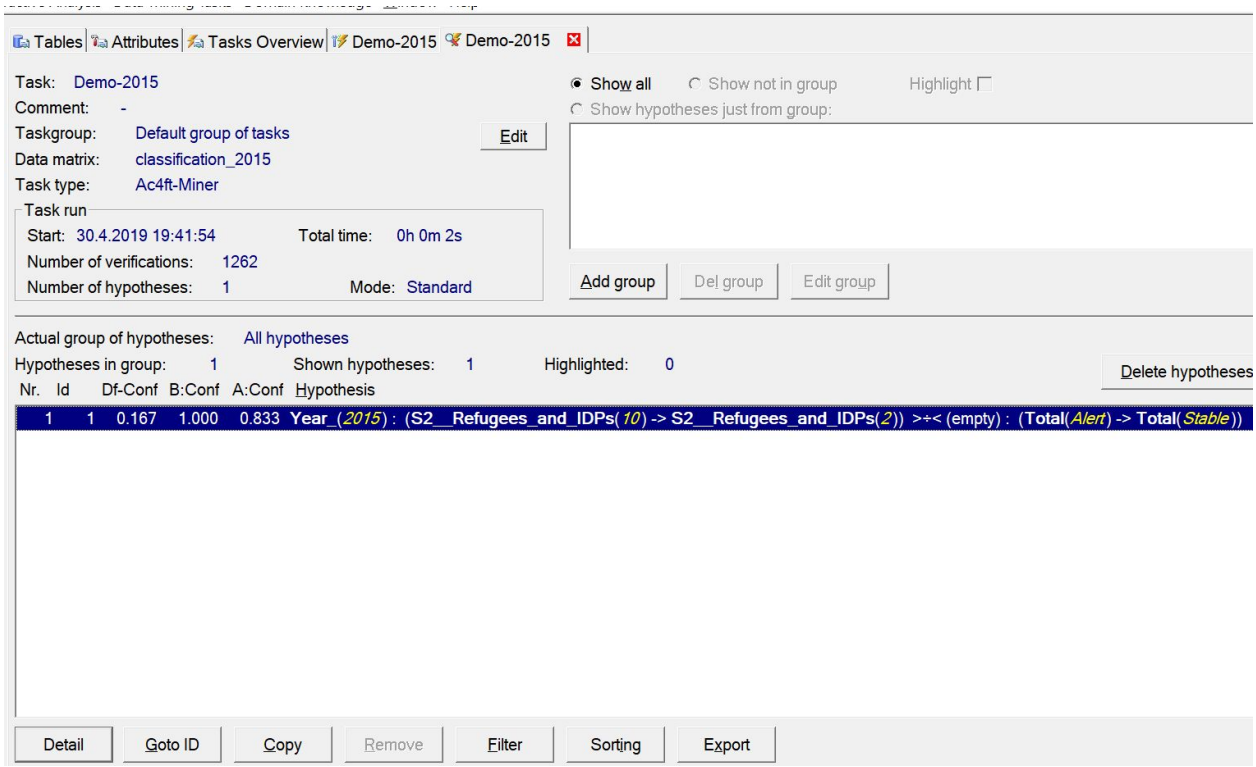
Year_(2014) : (S2__Refugees_and_IDPs(8.2) -> S2__Refugees_and_IDPs(5.2)) >˜< (Total(Alert) -> Total(Warning))

For the status to transition from Alert to Sustainable: The highest confidence rule generated recommends reducing the Demographic Pressure score to be dropped to 5.2.

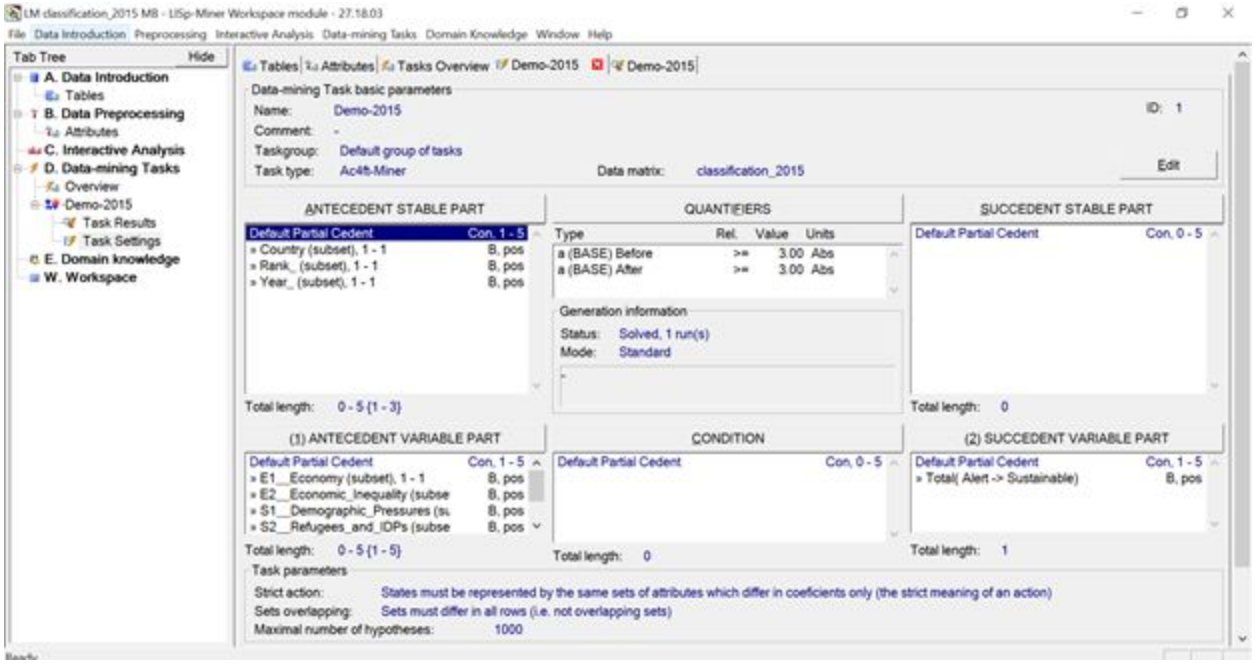
2015

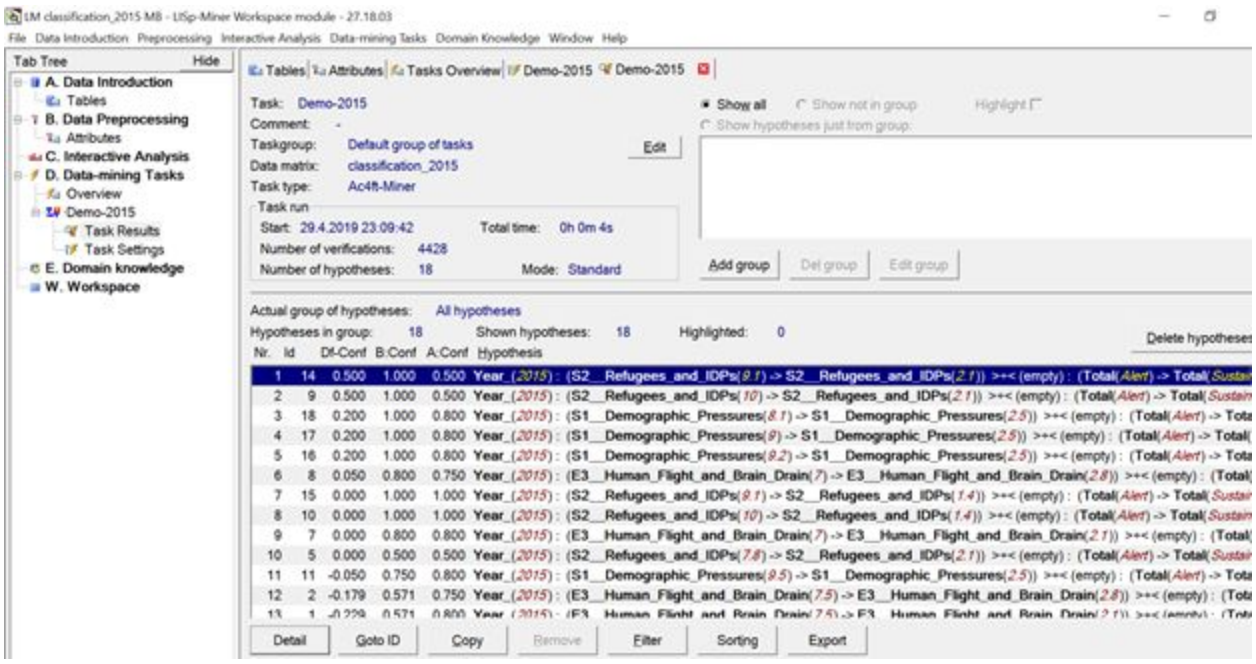
**** 2015(Alert -> Stable) ****





**** 2015 (Alert -> Sustainable) ****


LM classification_2015 MB - LISp-Miner Workspace module - 27.18.03
File Data Introduction Preprocessing Interactive Analysis Data-mining Tasks Domain Knowledge Window Help
Tab Tree
Hide
A. Data Introduction
Tables
B. Data Preprocessing
Attributes
C. Interactive Analysis
D. Data-mining Tasks
Overview
Demo-2015
Task Results
Task Settings
E. Domain knowledge
W. Workspace
Tables
Attributes
Tasks Overview
Demo-2015
Data-mining Task basic parameters
Name: Demo-2015
ID: 1
Comment: -
Taskgroup: Default group of tasks
Task type: Ac4ft-Miner
Data matrix: classification_2015
Edit
ANTECEDENT STABLE PART
Default Partial Cedent Con. 1 - 5
» Country (subset), 1 - 1 B, pos
» Rank_ (subset), 1 - 1 B, pos
» Year_ (subset), 1 - 1 B, pos
Total length: 0 - 5 {1 - 3}
QUANTIFIERS
Type Rel. Value Units
a (BASE) Before >= 3.00 Abs
a (BASE) After >= 3.00 Abs
Generation information
Status: Solved, 1 run(s)
Mode: Standard
SUCCEDENT STABLE PART
Default Partial Cedent Con. 0 - 5
Total length: 0
(1) ANTECEDENT VARIABLE PART
Default Partial Cedent Con. 1 - 5
» E1__Economy (subset), 1 - 1 B, pos
» E2__Economic_Inequality (subse B, pos
» S1__Demographic_Pressures (su B, pos
» S2__Refugees_and_IDPs (subse B, pos
Total length: 0 - 5 {1 - 5}
CONDITION
Default Partial Cedent Con. 0 - 5
Total length: 0
(2) SUCCEDENT VARIABLE PART
Default Partial Cedent Con. 1 - 5
» Total(Alert -> Sustainable) B, pos
Total length: 1
Task parameters
Strict action: States must be represented by the same sets of attributes which differ in coeficients only (the strict meaning of an action)
Sets overlapping: Sets must differ in all rows (i.e. not overlapping sets)
Maximal number of hypotheses: 1000


LM classification_2015 MB - LISp-Miner Workspace module - 27.18.03
File Data Introduction Preprocessing Interactive Analysis Data-mining Tasks Domain Knowledge Window Help
Tab Tree
Hide
A. Data Introduction
Tables
B. Data Preprocessing
Attributes
C. Interactive Analysis
D. Data-mining Tasks
Overview
Demo-2015
Task Results
Task Settings
E. Domain knowledge
W. Workspace
Tables
Attributes
Tasks Overview
Demo-2015
Task: Demo-2015
Comment: -
Taskgroup: Default group of tasks
Data matrix: classification_2015
Task type: Ac4ft-Miner
Edit
Task run
Start: 29.4.2019 23:09:42
Total time: 0h 0m 4s
Number of verifications: 4428
Number of hypotheses: 18
Mode: Standard
Show all
Show not in group
Highlight
Show hypotheses just from group:
Add group
Del group
Edit group
Actual group of hypotheses: All hypotheses
Hypotheses in group: 18
Shown hypotheses: 18
Highlighted: 0
Delete hypotheses
Nr. Id Df-Conf B:Conf A:Conf Hypothesis
1 14 0.500 1.000 0.500 Year_(2015) : (S2__Refugees_and_IDPs(9.1) -> S2__Refugees_and_IDPs(2.1)) >++< (empty) : (Total(Alert) -> Total(Sustai
2 9 0.500 1.000 0.500 Year_(2015) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(2.1)) >++< (empty) : (Total(Alert) -> Total(Sustain
3 18 0.200 1.000 0.800 Year_(2015) : (S1__Demographic_Pressures(8.1) -> S1__Demographic_Pressures(2.5)) >++< (empty) : (Total(Alert) -> Tota
4 17 0.200 1.000 0.800 Year_(2015) : (S1__Demographic_Pressures(9) -> S1__Demographic_Pressures(2.5)) >++< (empty) : (Total(Alert) -> Total(
5 16 0.200 1.000 0.800 Year_(2015) : (S1__Demographic_Pressures(9.2) -> S1__Demographic_Pressures(2.5)) >++< (empty) : (Total(Alert) -> Tota
6 8 0.050 0.800 0.750 Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(2.8)) >++< (empty) : (Total(
7 15 0.000 1.000 1.000 Year_(2015) : (S2__Refugees_and_IDPs(9.1) -> S2__Refugees_and_IDPs(1.4)) >++< (empty) : (Total(Alert) -> Total(Sustai
8 10 0.000 1.000 1.000 Year_(2015) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(1.4)) >++< (empty) : (Total(Alert) -> Total(Sustain
9 7 0.000 0.800 0.800 Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(2.1)) >++< (empty) : (Total(
10 5 0.000 0.500 0.500 Year_(2015) : (S2__Refugees_and_IDPs(7.8) -> S2__Refugees_and_IDPs(2.1)) >++< (empty) : (Total(Alert) -> Total(Sustai
11 11 -0.050 0.750 0.800 Year_(2015) : (S1__Demographic_Pressures(9.5) -> S1__Demographic_Pressures(2.5)) >++< (empty) : (Total(Alert) -> Tota
12 2 -0.179 0.571 0.750 Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7.5) -> E3__Human_Flight_and_Brain_Drain(2.8)) >++< (empty) : (Tota
Detail
Goto ID
Copy
Remove
Filter
Sorting
Export

**** 2015 (Alert -> Warning) ***

Tables | Attributes | Tasks Overview | Demo-2015 | Demo-2015

Data-mining Task basic parameters

Name: Demo-2015 ID: 1
Comment: -
Taskgroup: Default group of tasks
Task type: Ac4ft-Miner Data matrix: classification_2015 Edit

ANTECEDENT STABLE PART

Default Partial Cedent	Con, 1 - 5
» Country (subset), 1 - 1	B, pos
» Rank_ (subset), 1 - 1	B, pos
» Year_ (subset), 1 - 1	B, pos

Total length: 0 - 5 {1 - 3}

QUANTIFIERS

Type	Rel.	Value	Units
a (BASE) Before	>=	4.00	Abs
a (BASE) After	>=	4.00	Abs

Generation information
Status: Solved, 7 run(s)
Mode: Standard
-

SUCCEDENT STABLE PART

Default Partial Cedent	Con, 0 - 5

Total length: 0

(1) ANTECEDENT VARIABLE PART

Default Partial Cedent	Con, 1 - 5
» E1__Economy (subset), 1 - 1	B, pos
» E2__Economic_Inequality (subse	B, pos
» S1__Demographic_Pressures (su	B, pos
» S2__Refugees_and_IDPs (subse	B, pos

Total length: 0 - 5 {1 - 5}

CONDITION

Default Partial Cedent	Con, 0 - 5

Total length: 0

(2) SUCCEDENT VARIABLE PART

Default Partial Cedent	Con, 1 - 5
» Total(Alert -> Warning)	B, pos

Total length: 1

Task parameters
Strict action: States must be represented by the same sets of attributes which differ in coeficients only (the strict meaning of an action)
Sets overlapping: Sets must differ in all rows (i.e. not overlapping sets)
Maximal number of hypotheses: 1000

Tables | Attributes | Tasks Overview | Demo-2015 | Demo-2015

Task: Demo-2015
Comment: -
Taskgroup: Default group of tasks Edit
Data matrix: classification_2015
Task type: Ac4ft-Miner

Task run
Start: 30.4.2019 21:24:30 Total time: 0h 0m 1s
Number of verifications: 1262
Number of hypotheses: 15 Mode: Standard

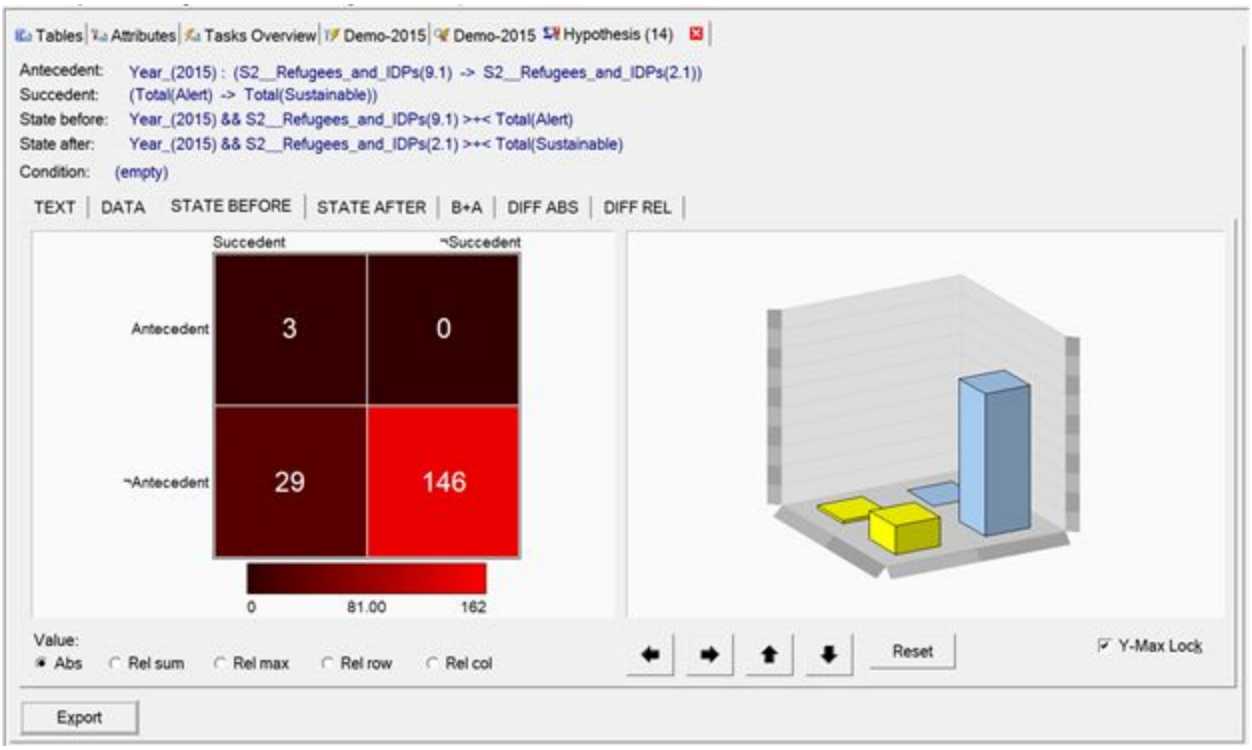
Show all | Show not in group | Highlight
Show hypotheses just from group:
Add group | Del group | Edit group

Actual group of hypotheses: All hypotheses
Hypotheses in group: 15 Shown hypotheses: 15 Highlighted: 0 Delete hypotheses

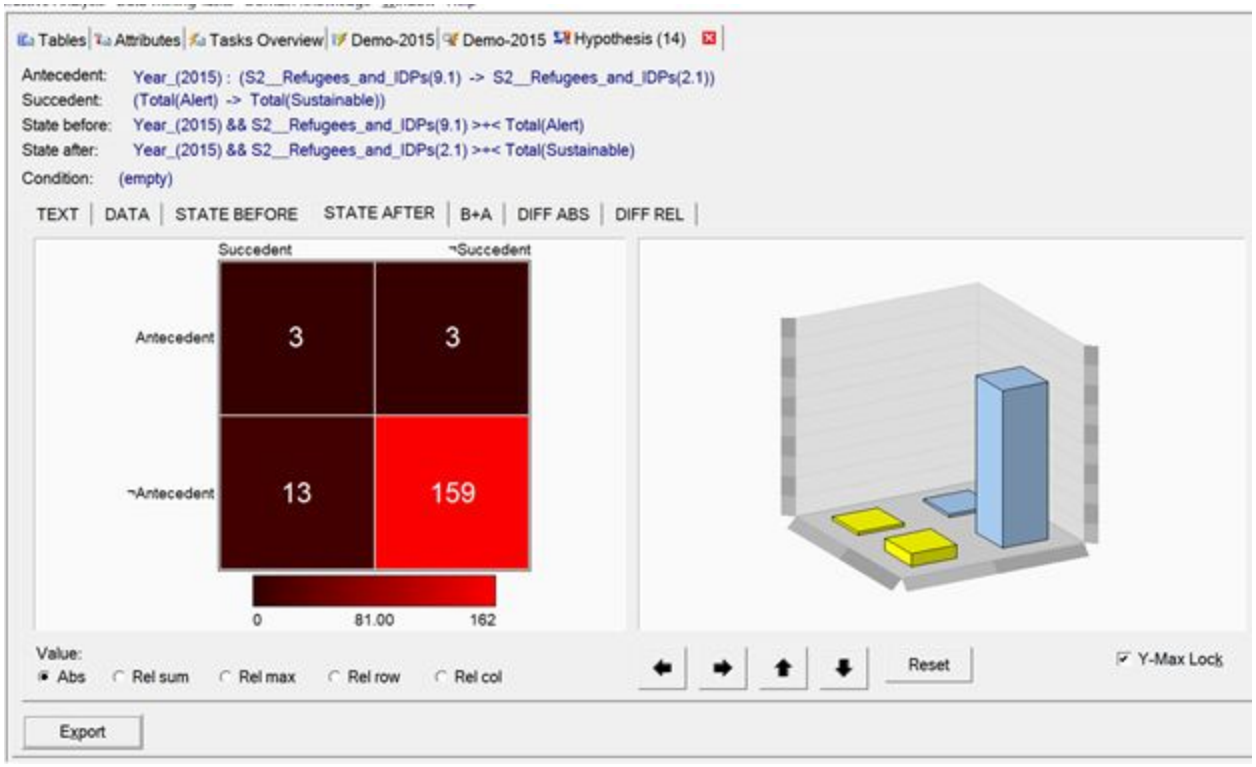
Nr.	Id	Df-Conf	B:Conf	A:Conf	Hypothesis
1	8	0.229	0.800	0.571	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(6.9)) >+< (empty) : (Total(
2	15	0.000	1.000	1.000	Year_(2015) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(7.4)) >+< (empty) : (Total(Alert) -> Total(Warning
3	10	0.000	0.800	0.800	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(7.6)) >+< (empty) : (Total(
4	11	0.000	0.800	0.800	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(7.4)) >+< (empty) : (Total(
5	12	0.000	0.800	0.800	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(6.3)) >+< (empty) : (Total(
6	1	0.000	0.571	0.571	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7.5) -> E3__Human_Flight_and_Brain_Drain(6.9)) >+< (empty) : (Tota
7	9	-0.200	0.800	1.000	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(5.5)) >+< (empty) : (Total(
8	13	-0.200	0.800	1.000	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(7.8)) >+< (empty) : (Total(
9	14	-0.200	0.800	1.000	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(6.4)) >+< (empty) : (Total(
10	3	-0.229	0.571	0.800	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7.5) -> E3__Human_Flight_and_Brain_Drain(7.6)) >+< (empty) : (Tota
11	4	-0.229	0.571	0.800	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7.5) -> E3__Human_Flight_and_Brain_Drain(7.4)) >+< (empty) : (Tota
12	5	-0.229	0.571	0.800	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7.5) -> E3__Human_Flight_and_Brain_Drain(6.3)) >+< (empty) : (Tota
13	2	-0.429	0.571	1.000	Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7.5) -> E3__Human_Flight_and_Brain_Drain(5.5)) >+< (empty) : (Tota

Detail | Goto ID | Copy | Remove | Filter | Sorting | Export

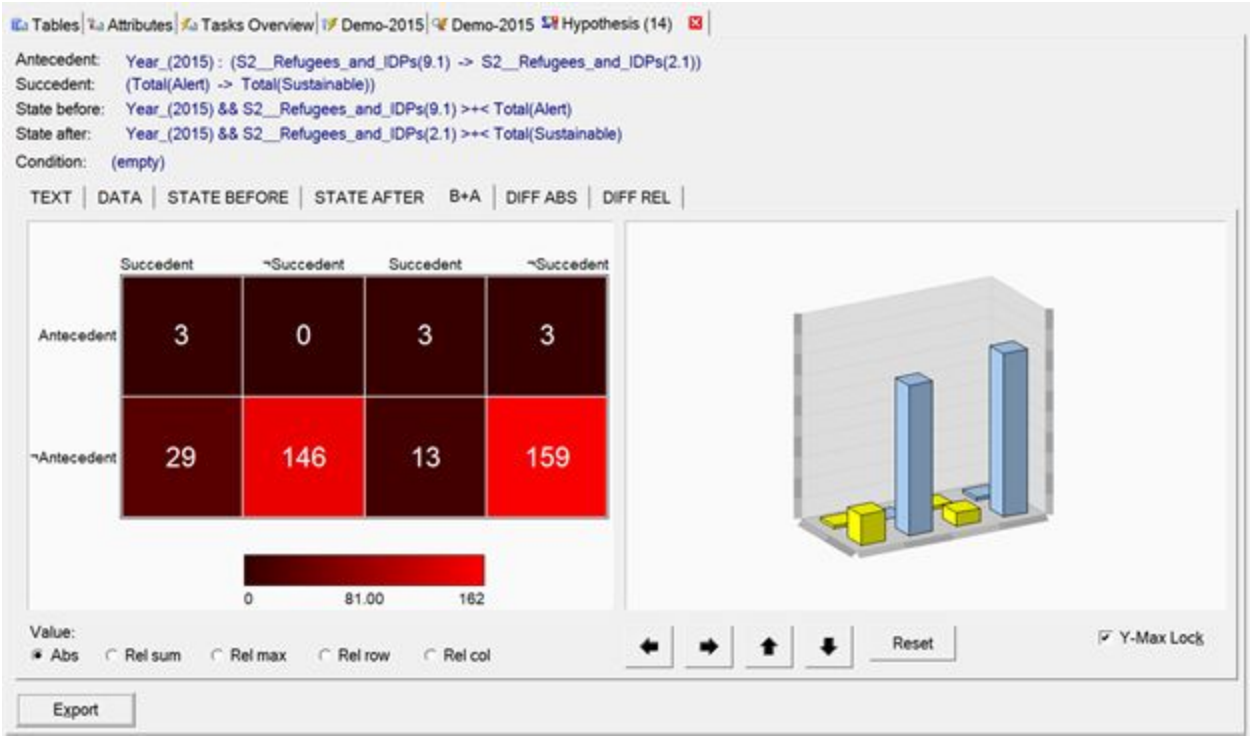
State Before



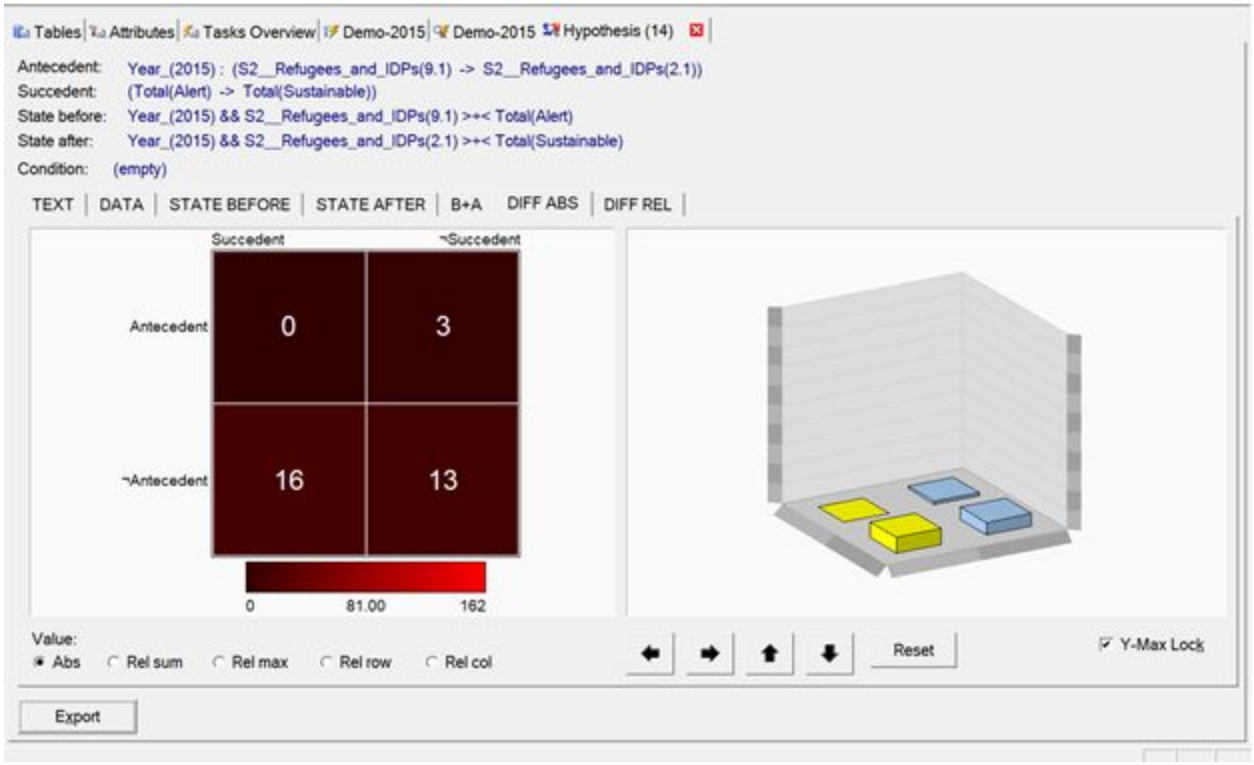
State After


Tables
Attributes
Tasks Overview
Demo-2015
Demo-2015
Hypothesis (14)
Antecedent: Year_(2015) : (S2__Refugees_and_IDPs(9.1) -> S2__Refugees_and_IDPs(2.1))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2015) && S2__Refugees_and_IDPs(9.1) >+< Total(Alert)
State after: Year_(2015) && S2__Refugees_and_IDPs(2.1) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
3
3
13
159
0
81.00
162
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

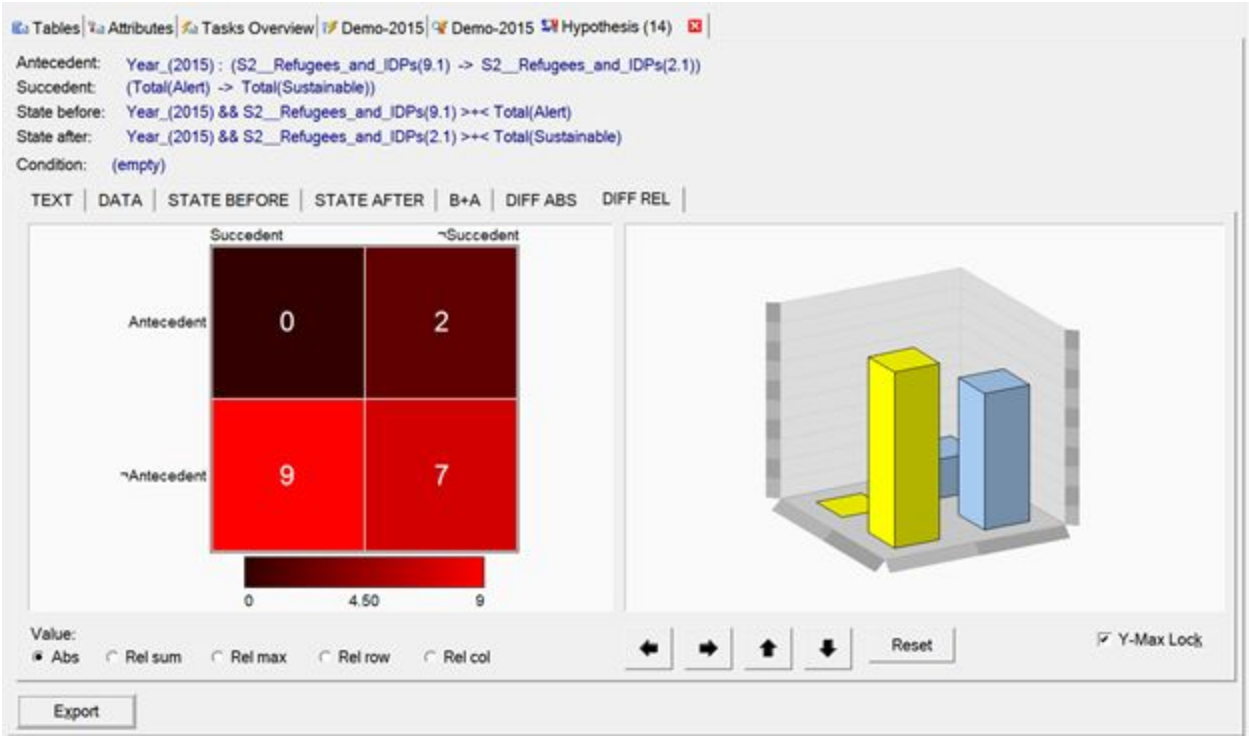
B+A


Tables
Attributes
Tasks Overview
Demo-2015
Demo-2015
Hypothesis (14)
Antecedent: Year_(2015) : (S2__Refugees_and_IDPs(9.1) -> S2__Refugees_and_IDPs(2.1))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2015) && S2__Refugees_and_IDPs(9.1) >+< Total(Alert)
State after: Year_(2015) && S2__Refugees_and_IDPs(2.1) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Succedent
¬Succedent
Antecedent
3
0
3
3
¬Antecedent
29
146
13
159
0
81.00
162
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

DIFF ABS


Tables
Attributes
Tasks Overview
Demo-2015
Demo-2015
Hypothesis (14)
Antecedent: Year_(2015) : (S2__Refugees_and_IDPs(9.1) -> S2__Refugees_and_IDPs(2.1))
Succedent: (Total(Alert) -> Total(Sustainable))
State before: Year_(2015) && S2__Refugees_and_IDPs(9.1) >+< Total(Alert)
State after: Year_(2015) && S2__Refugees_and_IDPs(2.1) >+< Total(Sustainable)
Condition: (empty)
TEXT
DATA
STATE BEFORE
STATE AFTER
B+A
DIFF ABS
DIFF REL
Succedent
¬Succedent
Antecedent
¬Antecedent
0
3
16
13
0
81.00
162
Value:
Abs
Rel sum
Rel max
Rel row
Rel col
Reset
Y-Max Lock
Export

DIFF REL



Analysis:

The action rule mining provided the following results:

Year_(2015) : (S2__Refugees_and_IDPs(10) -> S2__Refugees_and_IDPs(2)) >˜< (Total(Alert) -> Total(Stable))

For the status to transition from Alert to Stable: The highest confidence rule generated recommends reducing the Refugee and IDP score to be dropped to 2.

Year_(2015) : (S2__Refugees_and_IDPs(9.1) -> S2__Refugees_and_IDPs(2.1)) >˜< (Total(Alert) -> Total(Sustainable))

For the status to transition from Alert to Sustainable: The highest confidence rule generated recommends reducing the Refugee and IDP score to be dropped to 2.1.

Year_(2015) : (E3__Human_Flight_and_Brain_Drain(7) -> E3__Human_Flight_and_Brain_Drain(6.9)) >~< (Total(Alert) -> Total(Warning))

For the status to transition from Alert to Warning: The highest confidence rule generated recommends reducing the Human Flight and Brain Drain score to be dropped to 6.9.

Conclusion:

The dataset was discretized and merged, and using Weka we performed classification. We produced action rules using LISp-Miner for the Fragile State Index datasets for the years 2013, 2014 and 2015. It provided insight into specific cohesion, political, social or economic indicators countries could focus on to improve their conditions and reduce their index status.

References:

1) https://en.wikipedia.org/wiki/Fragile_States_Index
2) https://databank.worldbank.org/data/home.aspx
3) http://hdr.undp.org/en/data