Evaluation of Decision Tree in KNIME

Learning Objectives

At the end of this activity, you will be able to perform the following operations in KNIME:

1. Create and interpret a confusion matrix for a decision tree
2. Determine the accuracy rate of a decision tree model
3. Use highlighting to analyze classification errors

Problem Description

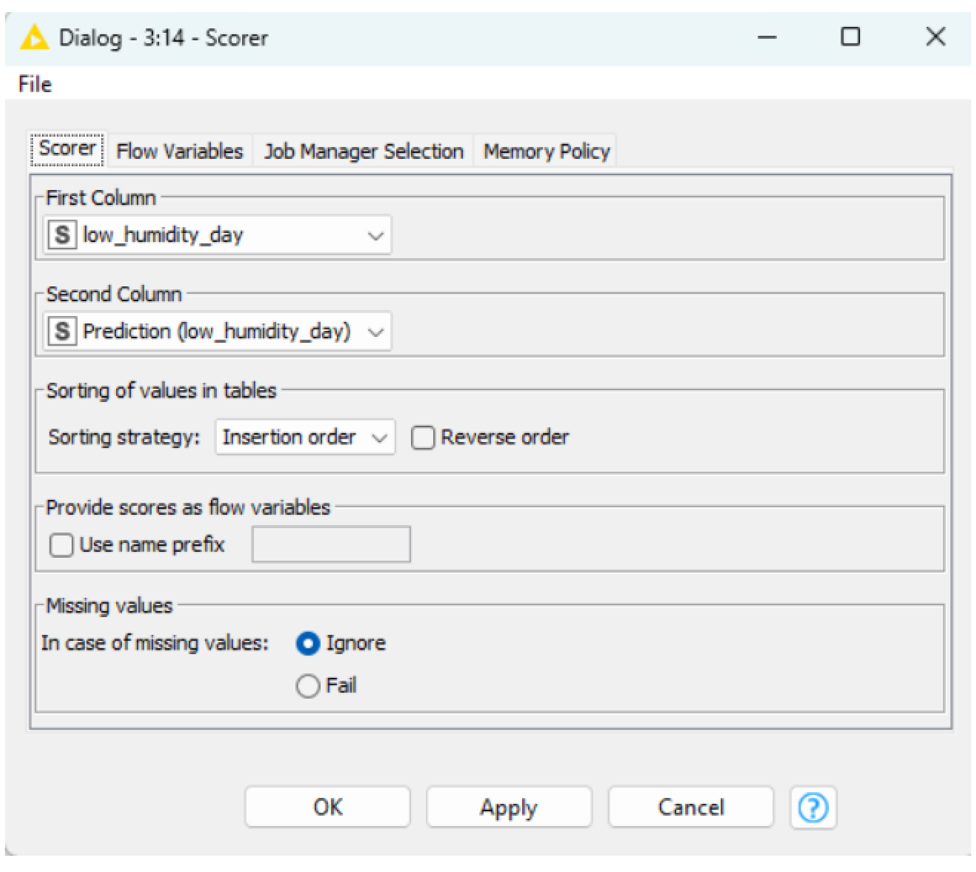
With the decision tree classifier built, we now need to evaluate its performance.

Steps

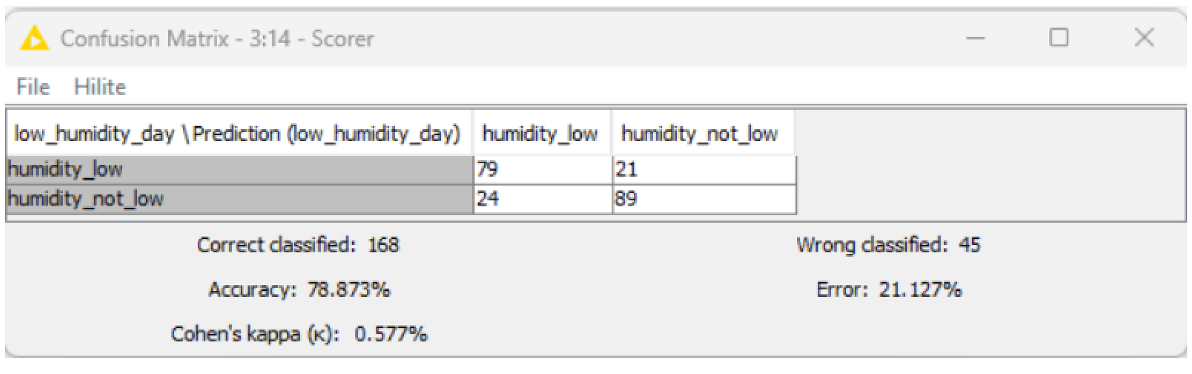
Generate a Confusion Matrix and Determine Accuracy Rate

A confusion matrix shows the type of errors and correct classifications that a classifier makes. It can be generated using a **Scorer** node.

1. Open the Decision Tree Workflow that you created from the Classification Hands-On reading.
2. Connect a **Scorer** node to the existing **Decision Tree Predictor**.
3. The Scorer Configure Dialog should look like this by default. Click OK.



Execute and view the **Scorer** node. It shows the confusion matrix, along with the accuracy of the prediction. Here you should see an accuracy rate of 78.873% if you followed all the hands-on instructions.



Confusion Matrix - 3:14 - Scorer

File   Hilite

low_humidity_day \ Prediction (low_humidity_day)	humidity_low	humidity_not_low
humidity_low	79	21
humidity_not_low	24	89

Correct classified: 168   Wrong classified: 45

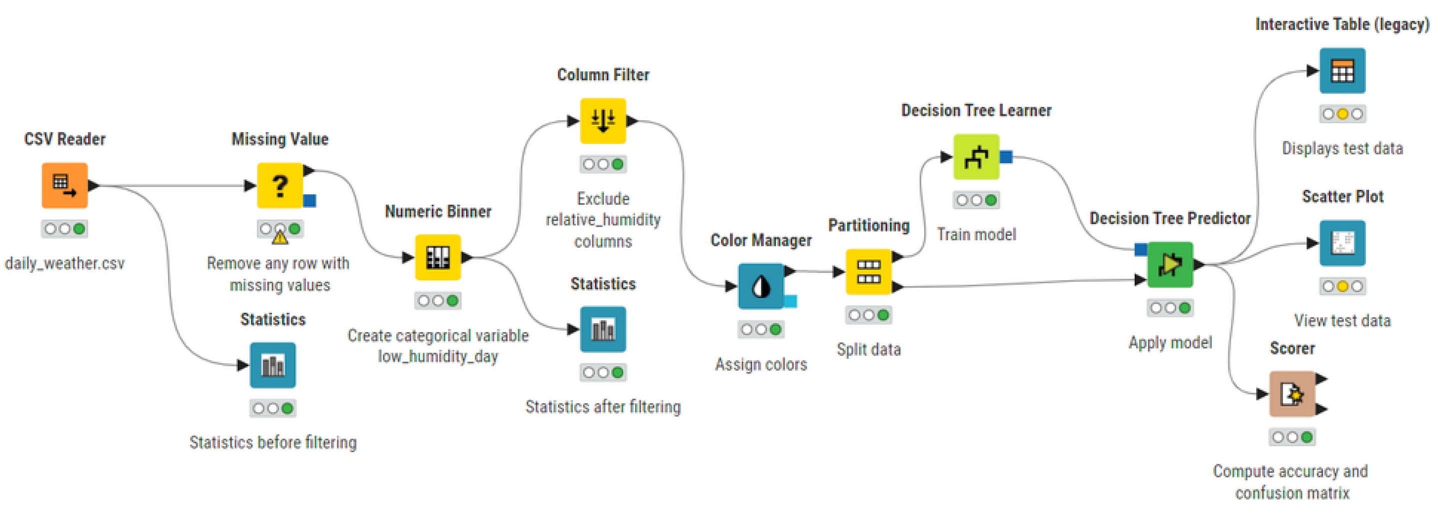
Accuracy: 78.873%   Error: 21.127%

Cohen's kappa (κ): 0.577%

From the confusion matrix, we see the following:

- There are 213 samples in the test data set (the sum of all the values in the confusion matrix)
- 79 humidity_low samples were correctly classified
- 89 humidity_not_low samples were correctly classified
- The accuracy rate is (79 + 89) / 213 = 168 / 213 = 78.873%
- 21 humidity_low samples were incorrectly classified as humidity_not_low
- 24 humidity_not_low samples were incorrectly classified as humidity_low
- The error rate is (21 + 24) / 213 = 45 / 213 = 21.127%

Use Highlighting and Scatter Plot to Analyze Classification Errors



A good way to enhance analysis of incorrect predictions is to visualize them. This can be accomplished using a feature called **hiliting**, and viewing the data in a **Scatter Plot** node.

1. Connect an **Interactive Table** node to the **Decision Tree Predictor**.
2. Execute and view this **Interactive Table** to see the input values for each sample (row), along with the ACTUAL/ TRUE low_humidity_day value and the PREDICTED low_humidity_day value. The red and green squares next to the Row ID color-codes the actual/true label (low or not). You can use this table to analyze samples whose true value differs from the predicted value (incorrect prediction).
3. Connect a **Scatter Plot** node to the **Decision Tree Predictor**.
4. Open the Configure Dialog and define the **Scatter Plot** as following:
    a. Horizontal dimension: air_pressure_9am
    b. Vertical dimension: air_temp_9am
    c. Color dimension: low_humidity_day
    d. Axis limits: Domain bounds
5. Execute and view the **Scatter Plot** node, and place the window side-by-side with the **Interactive Table** window.
6. Go through the the table looking for rows with predictions that are different from the true value.
7. When you find such a row, click anywhere on that row. At the top of the window click **Hilite > Hilite Selected**. This will make that row yellow in the table and in the Scatter Plot. It may be easiest to use the up and down arrow keys to navigate the rows of the table. In this example, we are just going to highlight the first 5 misclassifications.
8. Do this for any row with a misclassification. This allows you to pinpoint the misclassified samples and analyze them further. Analyzing the misclassified samples can bring insight into how to improve model performance. For example, if many samples with avg_temperature_9am between 60 and 70 degrees are misclassified, this suggests that more samples with these values for avg_temperature_9am are needed to train the model.

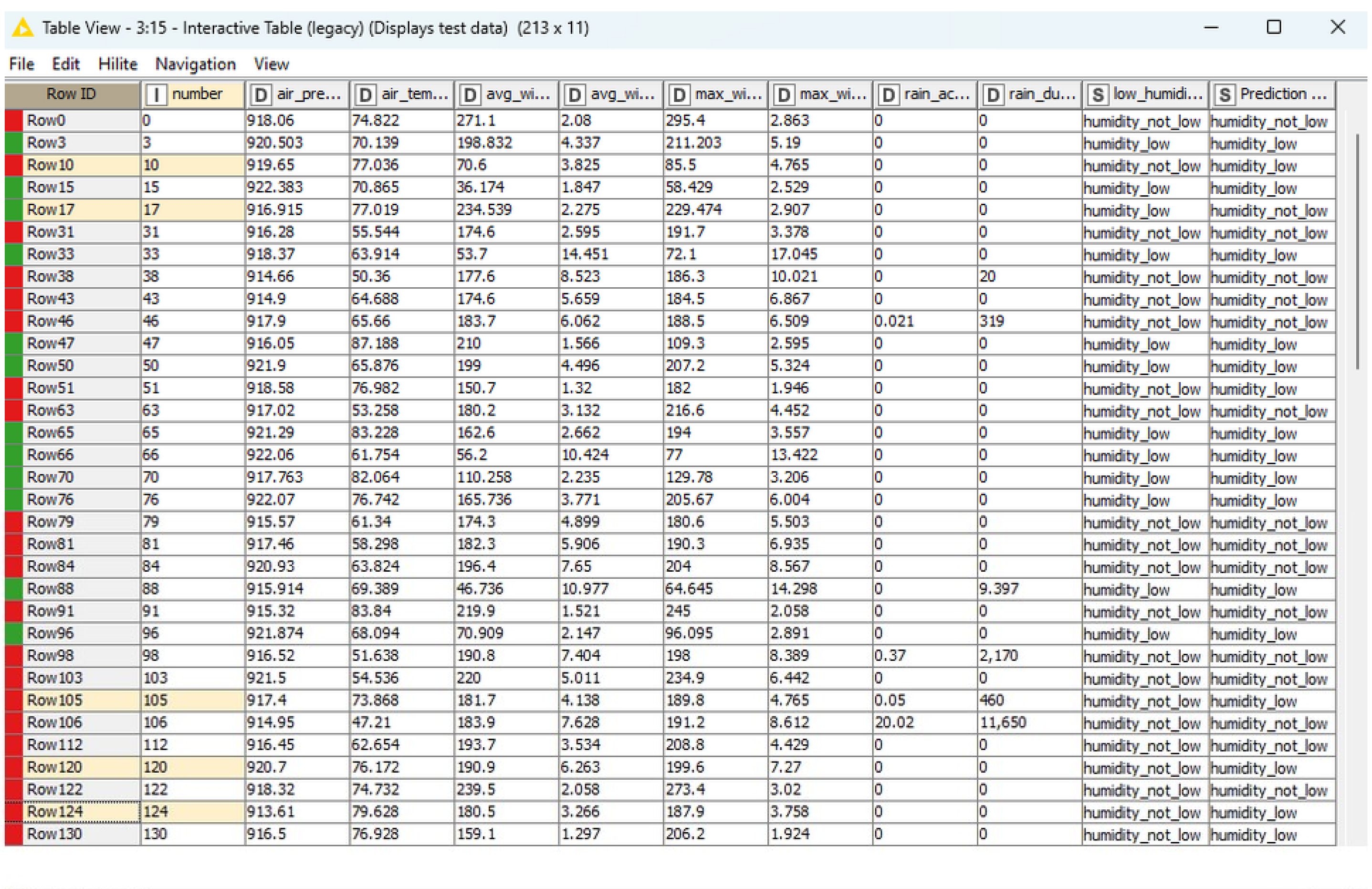
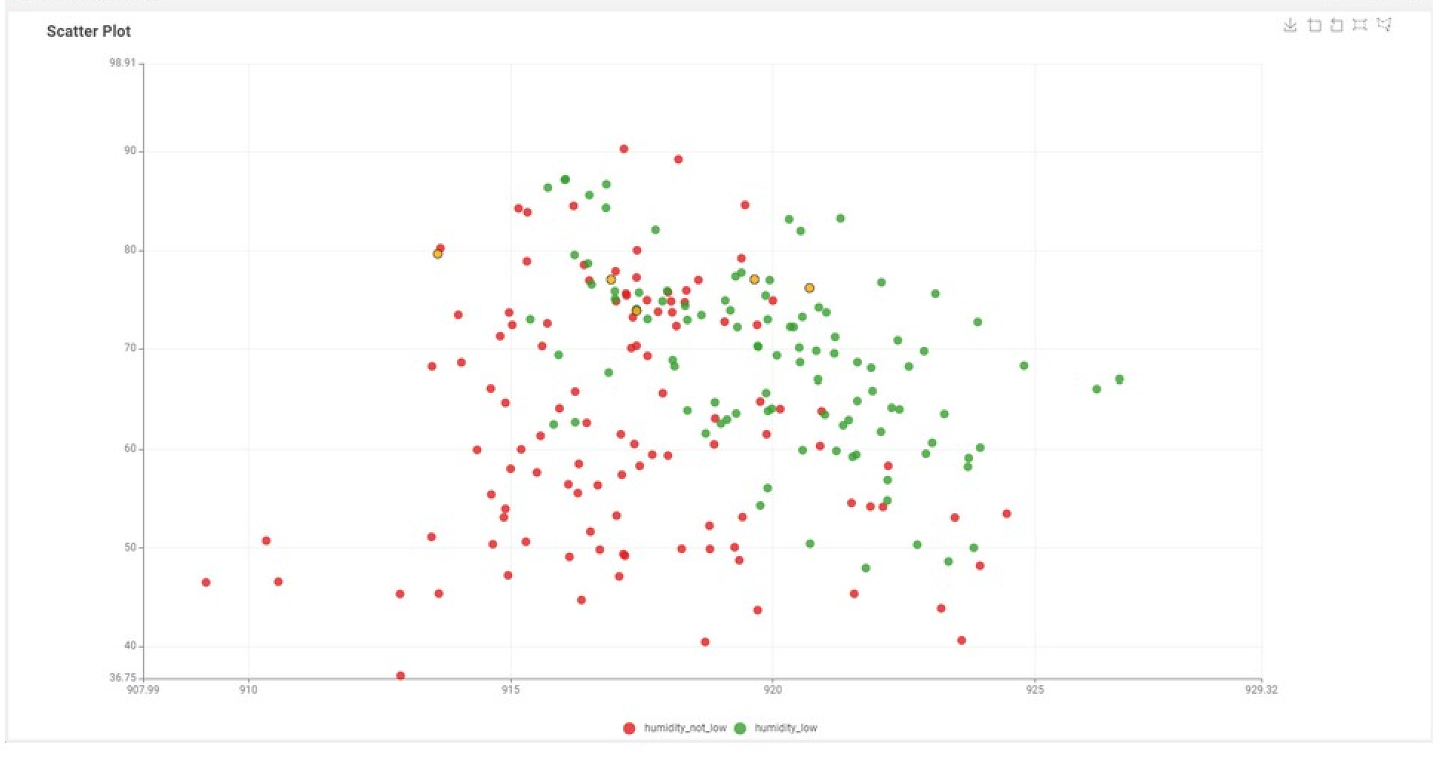


Table View - 3:15 - Interactive Table (legacy) (Displays test data) (213 x 11)

File   Edit   Hilite   Navigation   View

Row ID	I number	D air_pre...	D air_tem...	D avg_wi...	D avg_wi...	D max_wi...	D max_wi...	D rain_ac...	D rain_du...	S low_humidi...	S Prediction ...
Row0	0	918.06	74.822	271.1	2.08	295.4	2.863	0	0	humidity_not_low	humidity_not_low
Row3	3	920.503	70.139	198.832	4.337	211.203	5.19	0	0	humidity_low	humidity_low
Row10	10	919.65	77.036	70.6	3.825	85.5	4.765	0	0	humidity_not_low	humidity_low
Row15	15	922.383	70.865	36.174	1.847	58.429	2.529	0	0	humidity_low	humidity_low
Row17	17	916.915	77.019	234.539	2.275	229.474	2.907	0	0	humidity_low	humidity_not_low
Row31	31	916.28	55.544	174.6	2.595	191.7	3.378	0	0	humidity_not_low	humidity_not_low
Row33	33	918.37	63.914	53.7	14.451	72.1	17.045	0	0	humidity_low	humidity_low
Row38	38	914.66	50.36	177.6	8.523	186.3	10.021	0	20	humidity_not_low	humidity_not_low
Row43	43	914.9	64.688	174.6	5.659	184.5	6.867	0	0	humidity_not_low	humidity_not_low
Row46	46	917.9	65.66	183.7	6.062	188.5	6.509	0.021	319	humidity_not_low	humidity_not_low
Row47	47	916.05	87.188	210	1.566	109.3	2.595	0	0	humidity_low	humidity_low
Row50	50	921.9	65.876	199	4.496	207.2	5.324	0	0	humidity_low	humidity_low
Row51	51	918.58	76.982	150.7	1.32	182	1.946	0	0	humidity_not_low	humidity_low
Row63	63	917.02	53.258	180.2	3.132	216.6	4.452	0	0	humidity_not_low	humidity_not_low
Row65	65	921.29	83.228	162.6	2.662	194	3.557	0	0	humidity_low	humidity_low
Row66	66	922.06	61.754	56.2	10.424	77	13.422	0	0	humidity_low	humidity_low
Row70	70	917.763	82.064	110.258	2.235	129.78	3.206	0	0	humidity_low	humidity_low
Row76	76	922.07	76.742	165.736	3.771	205.67	6.004	0	0	humidity_low	humidity_low
Row79	79	915.57	61.34	174.3	4.899	180.6	5.503	0	0	humidity_not_low	humidity_not_low
Row81	81	917.46	58.298	182.3	5.906	190.3	6.935	0	0	humidity_not_low	humidity_not_low
Row84	84	920.93	63.824	196.4	7.65	204	8.567	0	0	humidity_not_low	humidity_not_low
Row88	88	915.914	69.389	46.736	10.977	64.645	14.298	0	9.397	humidity_low	humidity_low
Row91	91	915.32	83.84	219.9	1.521	245	2.058	0	0	humidity_not_low	humidity_not_low
Row96	96	921.874	68.094	70.909	2.147	96.095	2.891	0	0	humidity_low	humidity_low
Row98	98	916.52	51.638	190.8	7.404	198	8.389	0.37	2,170	humidity_not_low	humidity_not_low
Row103	103	921.5	54.536	220	5.011	234.9	6.442	0	0	humidity_not_low	humidity_not_low
Row105	105	917.4	73.868	181.7	4.138	189.8	4.765	0.05	460	humidity_not_low	humidity_low
Row106	106	914.95	47.21	183.9	7.628	191.2	8.612	20.02	11,650	humidity_not_low	humidity_not_low
Row112	112	916.45	62.654	193.7	3.534	208.8	4.429	0	0	humidity_not_low	humidity_not_low
Row120	120	920.7	76.172	190.9	6.263	199.6	7.27	0	0	humidity_not_low	humidity_low
Row122	122	918.32	74.732	239.5	2.058	273.4	3.02	0	0	humidity_not_low	humidity_not_low
Row124	124	913.61	79.628	180.5	3.266	187.9	3.758	0	0	humidity_not_low	humidity_low
Row130	130	916.5	76.928	159.1	1.297	206.2	1.924	0	0	humidity_not_low	humidity_low



Save Your Workflow

Save your workflow using <control>-s on Windows or <command>-s on Mac.