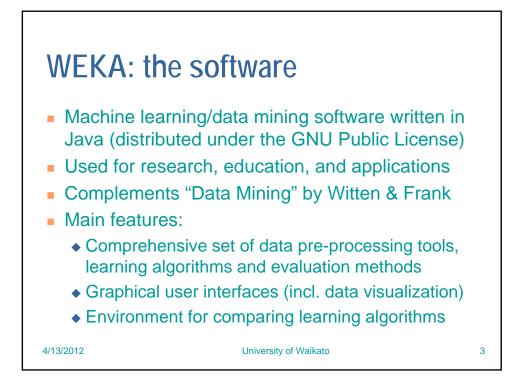
Machine Learning with WEKA

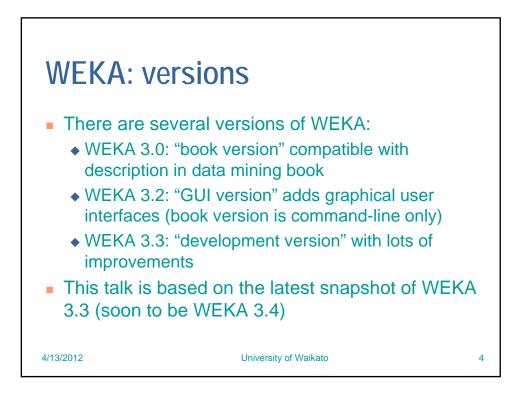
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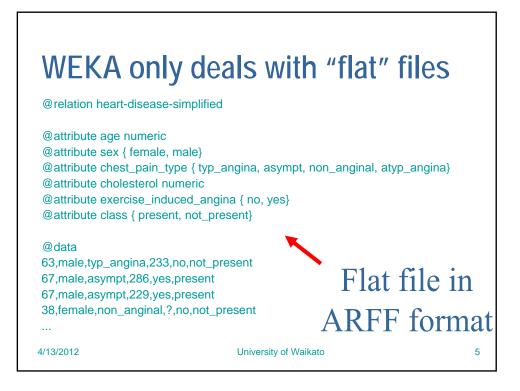
Department of Computer Science, University of Waikato, New Zealand

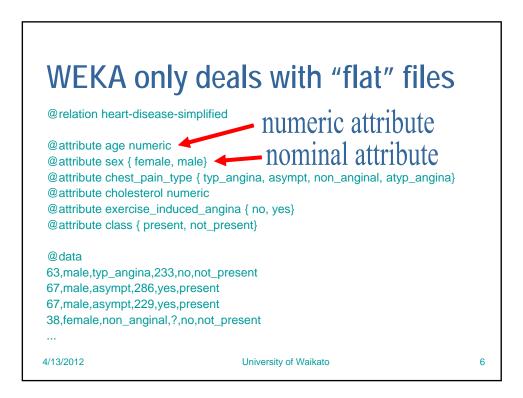
- WEKA: A Machine Learning Toolkit
- The Explorer
 - Classification and Regression
 - Clustering
 - Association Rules
 - Attribute Selection
 - Data Visualization
- The Experimenter
- The Knowledge Flow GUI
- Conclusions

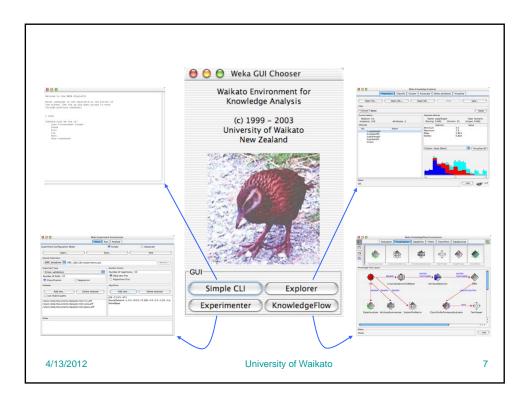


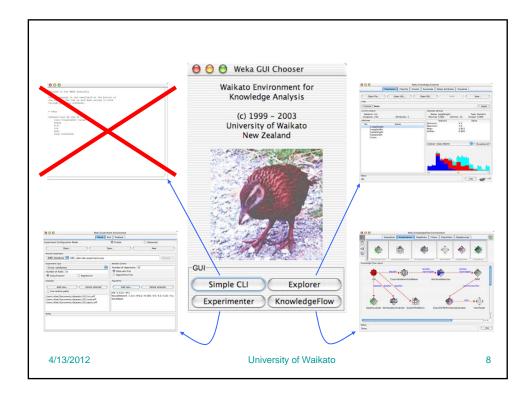


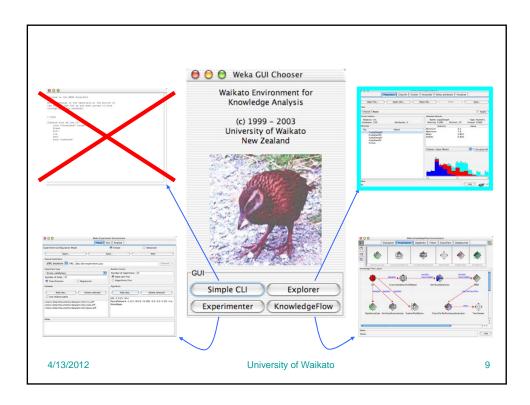


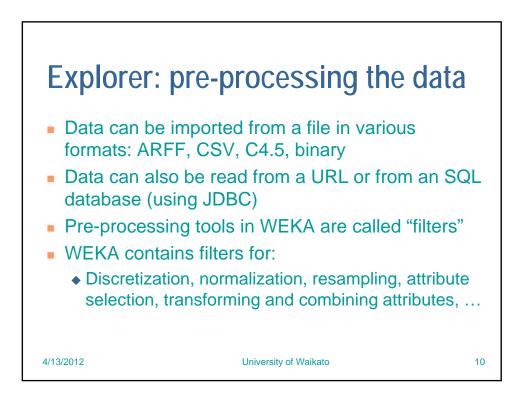






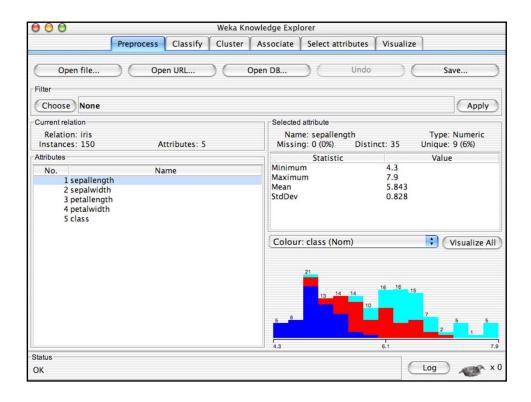


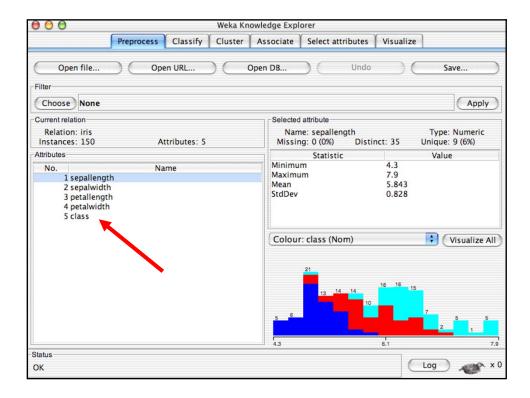


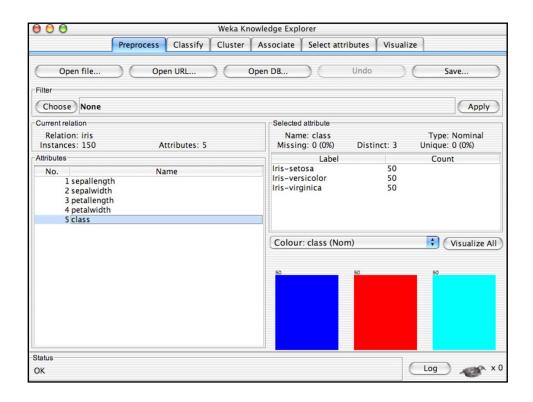


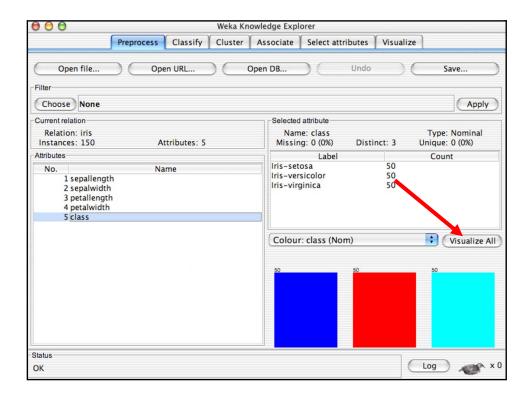
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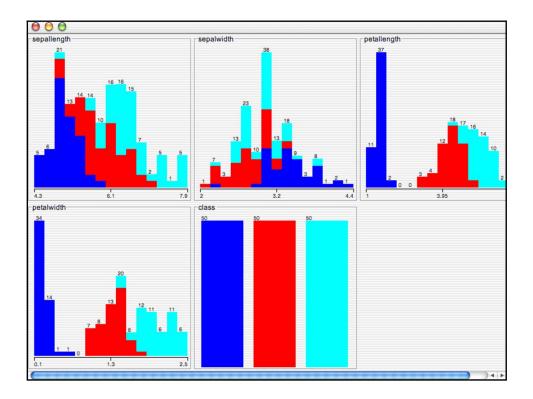
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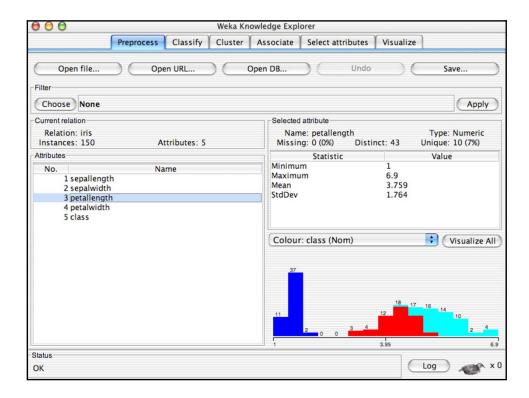




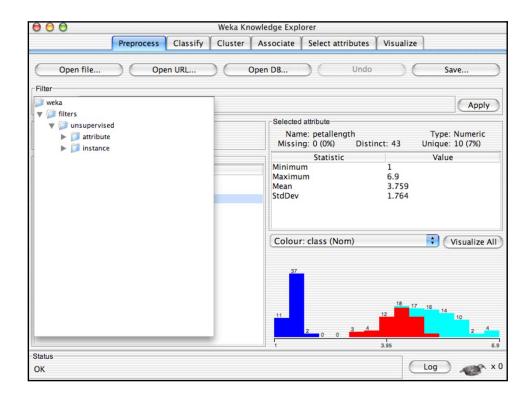


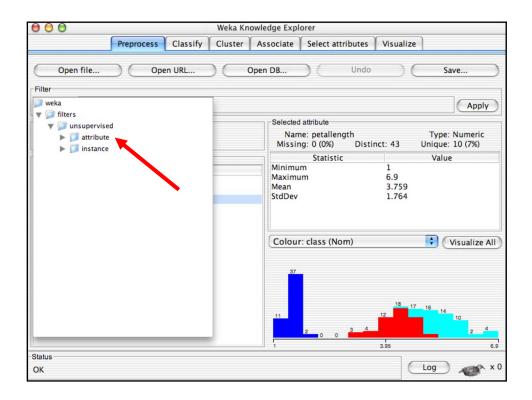


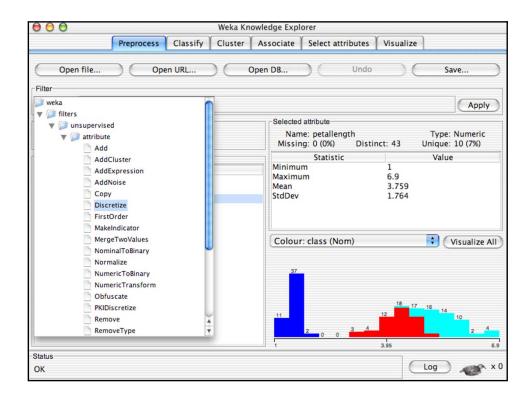




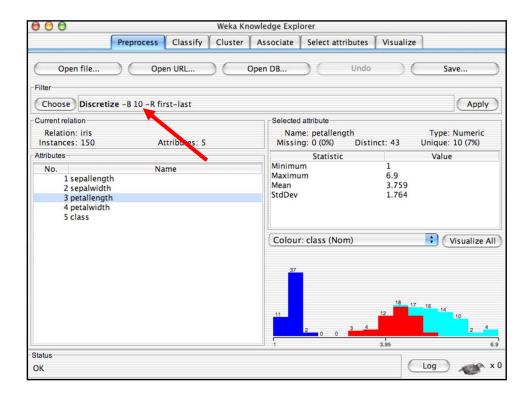
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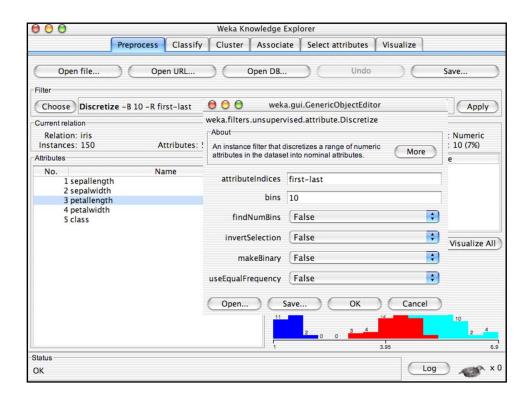


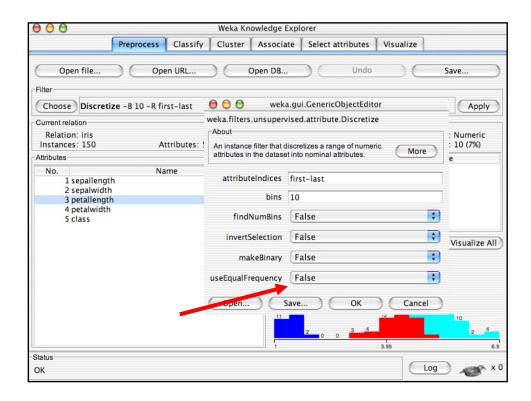




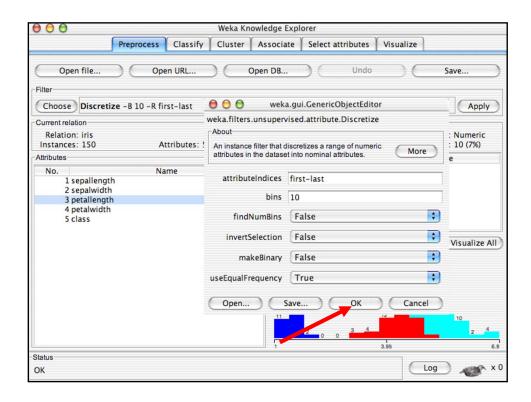
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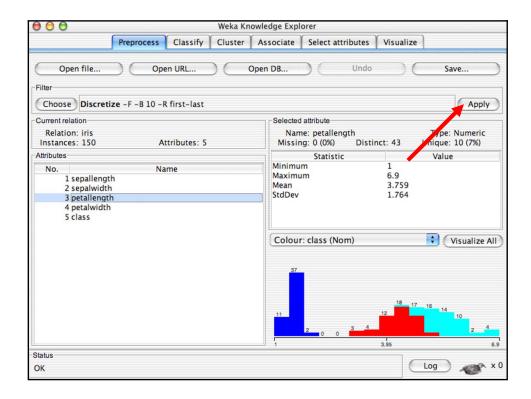


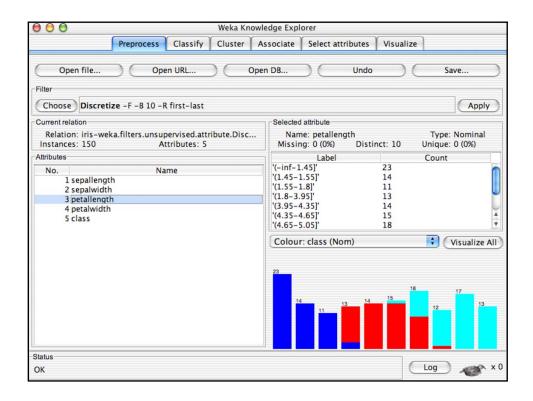


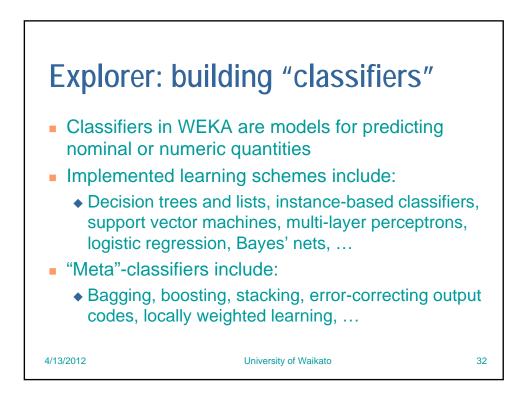
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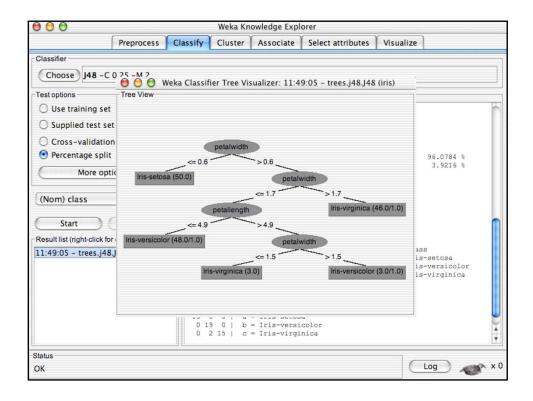
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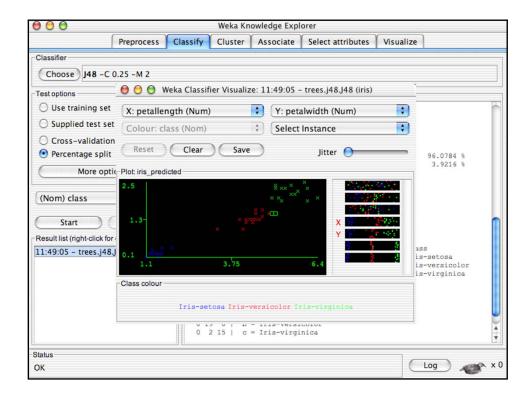
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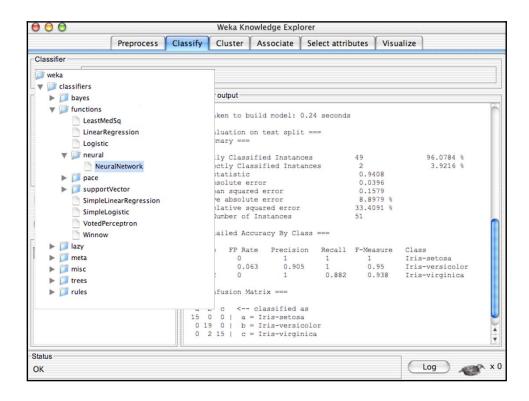


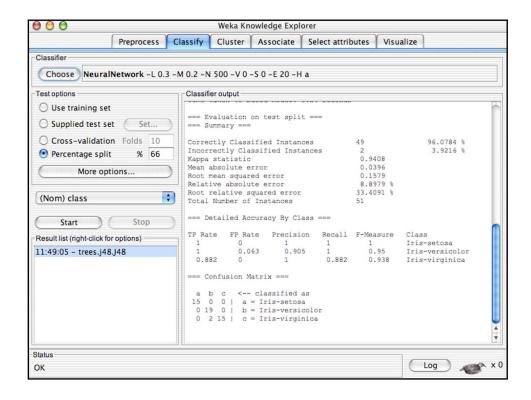
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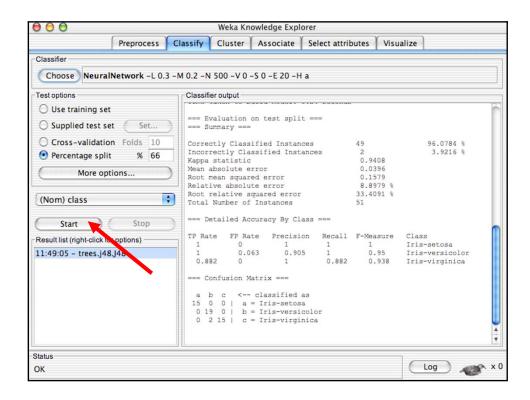


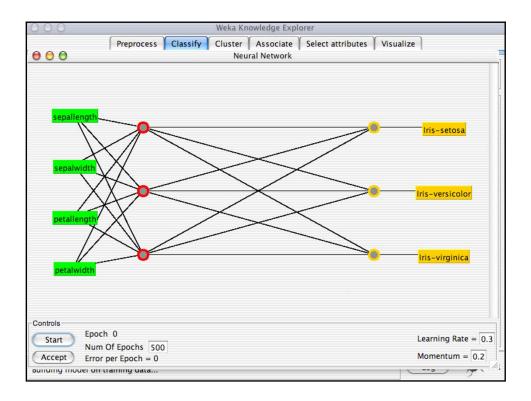
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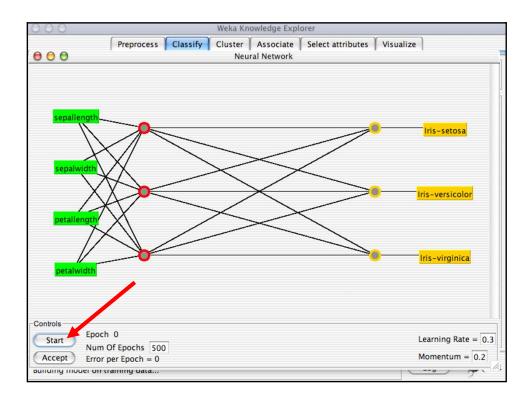
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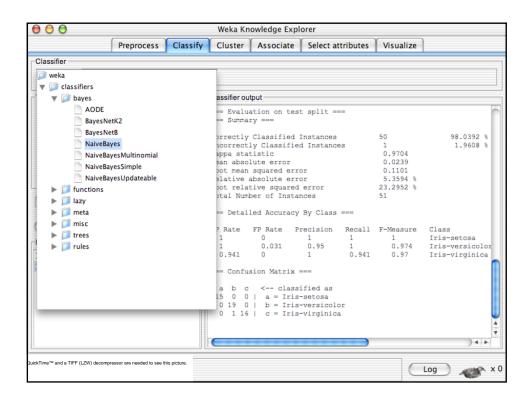






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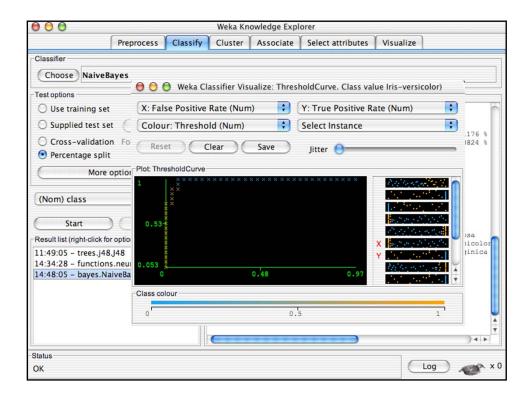
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Result list (right-click for options)	1	0	1	1	1	Iris-setosa Iris-versicolor
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11:49:05 - trees.j48.J48	0.941	0	1	0.941	0.97	Iris-virginica			
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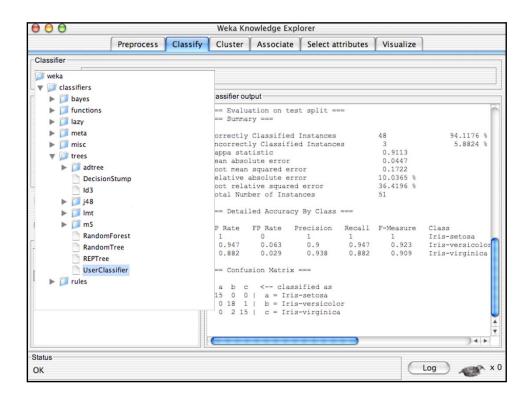
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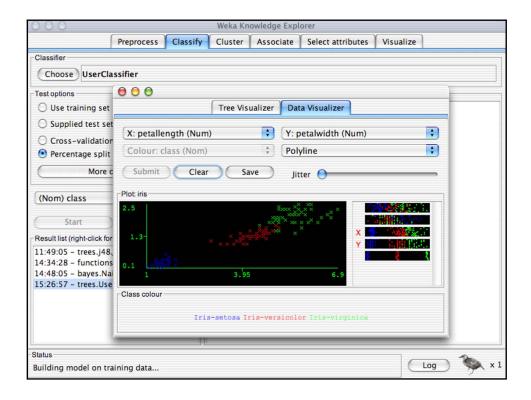
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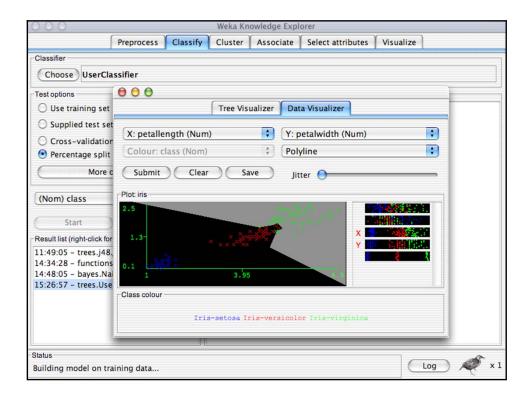
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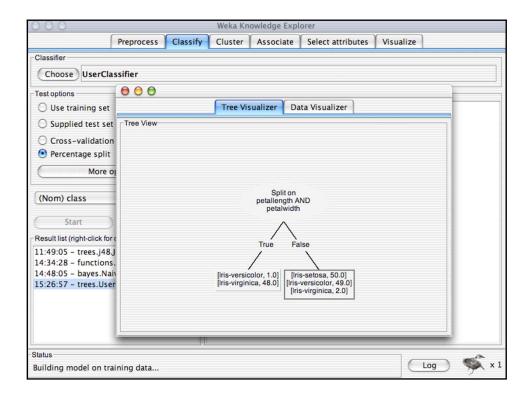


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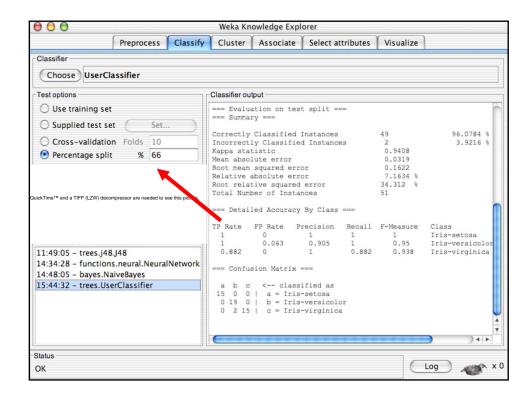
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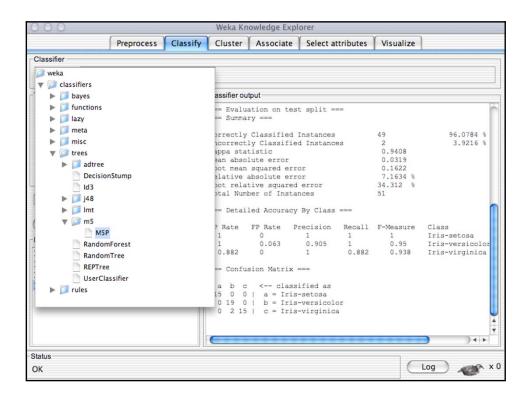


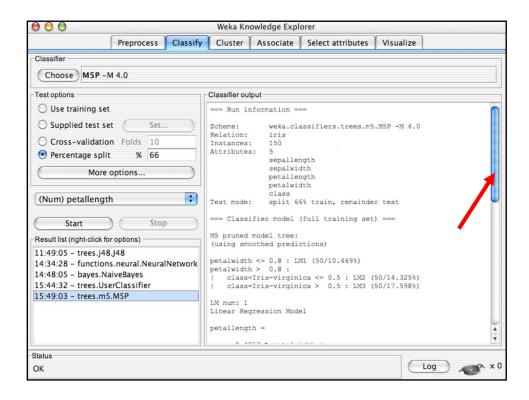
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14:34:28 - functions.neur 14:48:05 - bayes.NaiveBa	yes	Network	TP Rate 1 0.882 === Confus a b c 15 0 0	FP Rate 0 0.063 0 sion Matrix < clas a = Iri	Precision 1 0.905 1 c === ssified as c-setosa	Recall 1 1 0.882	1 0.95	Iris-setosa Iris-versicolos
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14:34:28 - functions.neur 14:48:05 - bayes.NaiveBa	yes	Network	TP Rate 1 0.882 === Confus a b c 15 0 0 0 19 0	FP Rate 0 0.063 0 sion Matrix < clas a = Iri b = Iri	Precision 1 0.905 1 c === ssified as c-setosa	Recall 1 1 0.882	1 0.95	Iris-setosa Iris-versicolos
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14:34:28 - functions.neur 14:48:05 - bayes.NaiveBa	yes	Network	TP Rate 1 0.882 === Confus a b c 15 0 0 0 19 0	FP Rate 0 0.063 0 sion Matrix < clas a = Iri b = Iri	Precision 1 0.905 1 s === sified as .s-setosa .s-versicolo	Recall 1 1 0.882	1 0.95	Iris-setosa Iris-versicolor Iris-virginica
14:34:28 – functions.neur 14:48:05 – bayes.NaiveBa 15:44:32 – trees.UserClas	yes	Network	TP Rate 1 0.882 === Confus a b c 15 0 0 0 19 0	FP Rate 0 0.063 0 sion Matrix < clas a = Iri b = Iri	Precision 1 0.905 1 s === sified as .s-setosa .s-versicolo	Recall 1 1 0.882	1 0.95 0.938	Iris-setosa Iris-versicolor Iris-virginica



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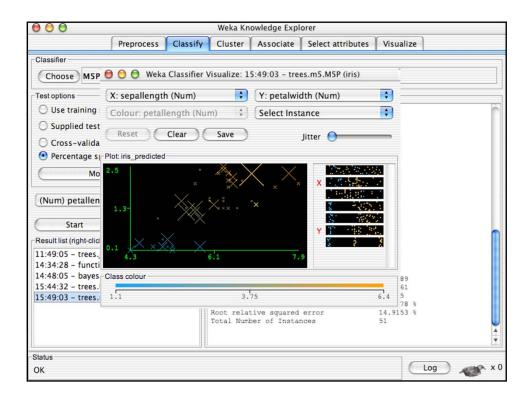


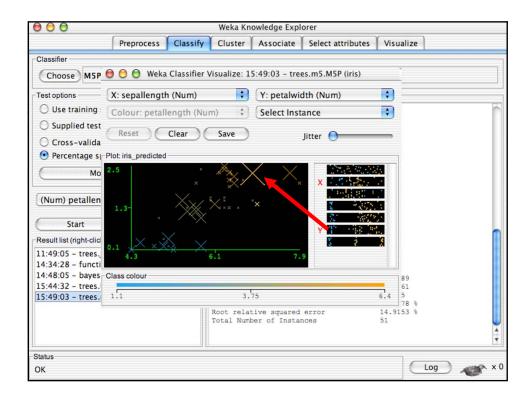


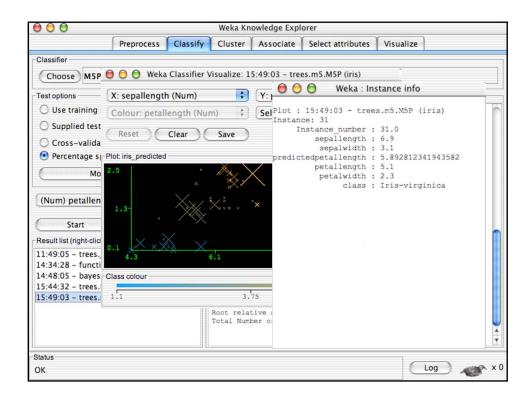
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Test options Use training set Supplied test set Set Cross-validation Folds 10 Percentage split % 66 More options (Num) petallength	Classifier output Classifier output I class=lris=virginica > 0.5 : LM3 (50/17.598%) LM num: 1 Linear Regression Model petallength = 0.4957 * petalwidth + 1.343 LM num: 2 Linear Regression Model
Start Stop Result list (right-click for options) 11:49:05 - trees.j48.J48 14:34:28 - functions.neural.NeuralNetwork 14:48:05 - bayes.NaiveBayes 15:44:32 - trees.UserClassifier 15:49:03 - trees.m5.M5P	<pre>petallength = 0.4208 * sepallength + 1.2692 * petalwidth + 0.0795 IM num: 3 Linear Regression Model petallength = 0.7501 * sepallength + 0.6105 Number of Rules : 3 * *</pre>
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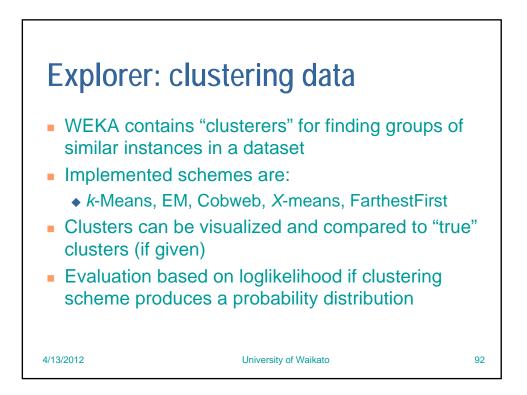
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15:44:32 - trees.UserClassifier 15:49:03 - trees.m5.M5P	Mean absolute error Root mean squared error Relative absolute error Root relative squared error Total Number of Instances	0.1861 0.255 11.9578 % 14.9153 % 51
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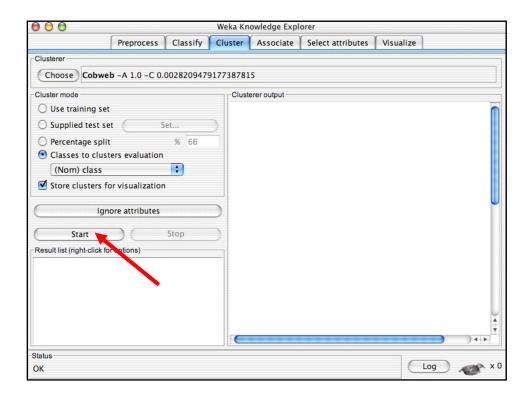
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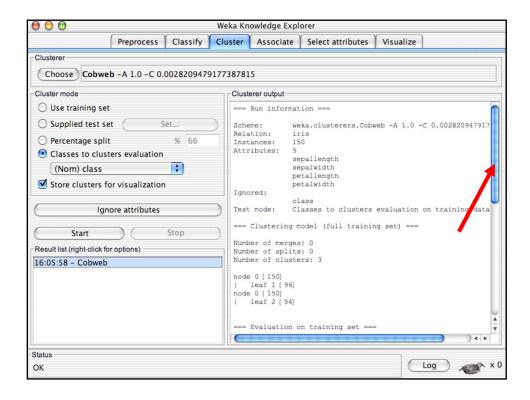
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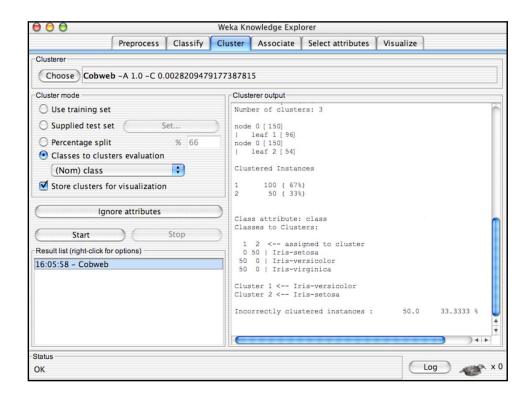
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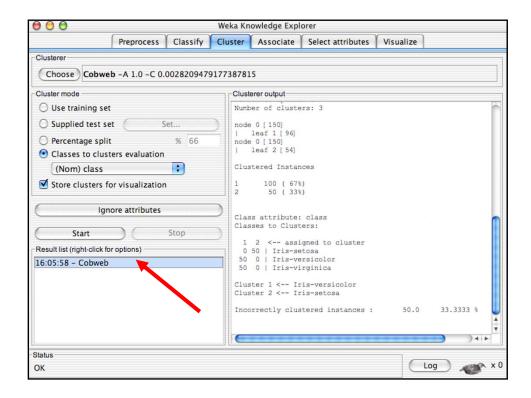
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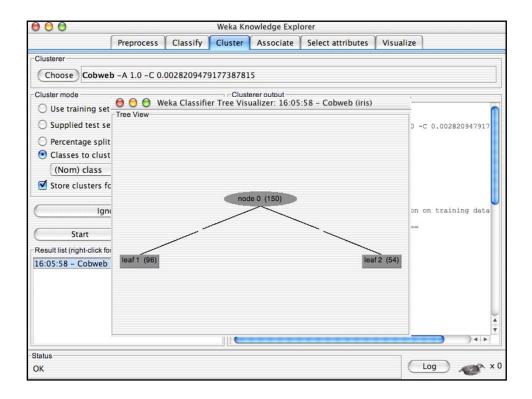
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(Start) Stop	=== Clustering model (full training set) ===				
Result list (right-click for options)	Number of merges: 0 Number of splits: 0				
16:05:58 - Cobweb	Number of clusters: 3				
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	=== Evaluation on training set ===				
	Evaluation on training set				
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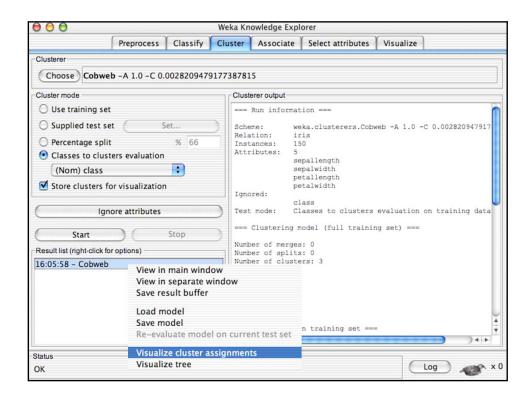


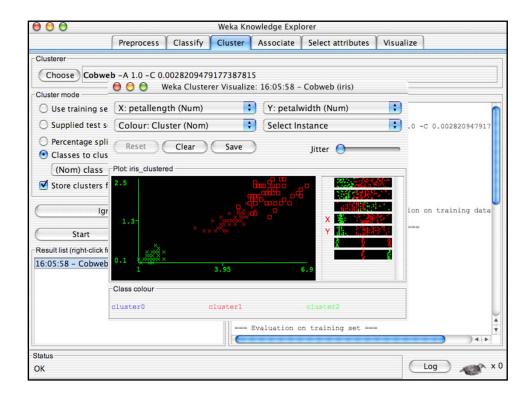


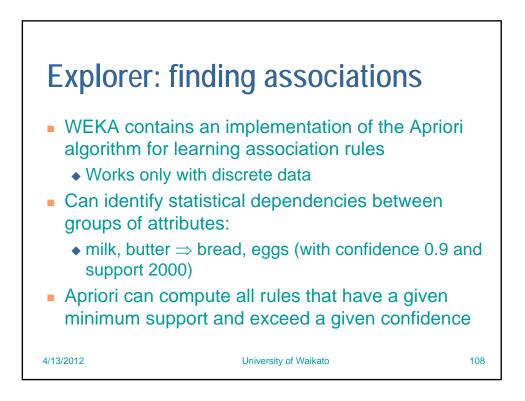


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16:05:58 - Cobweb	View in main window View in separate win Save result buffer Load model Save model Re-evaluate model of	dow
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Status OK	Visualize cluster ass Visualize tree	ignments



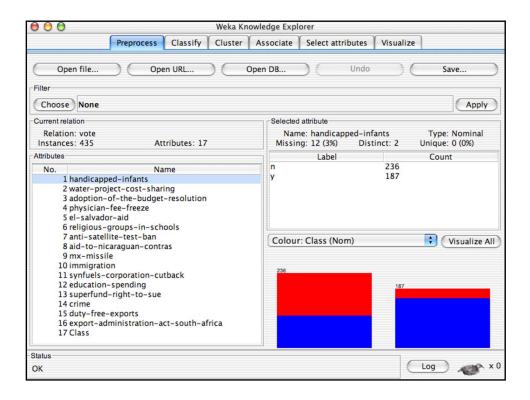


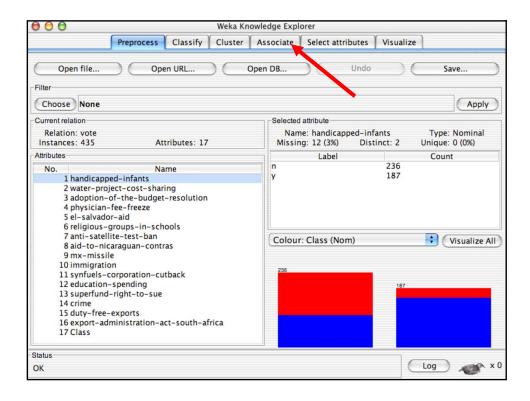




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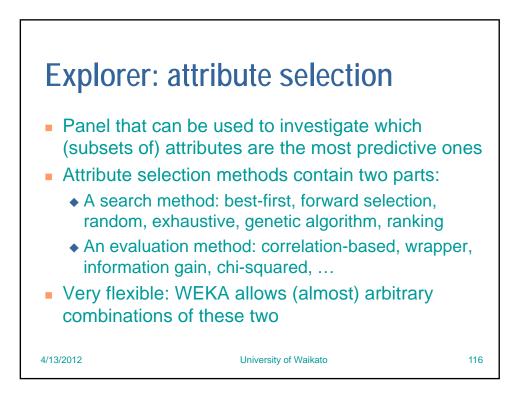




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6:29:37 - Apriori	Generat	ed sets of	large ite	msets:				
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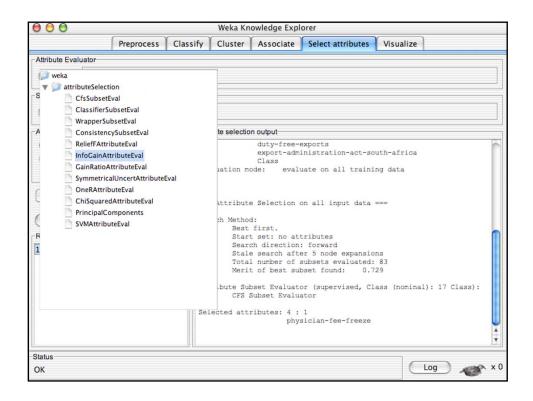


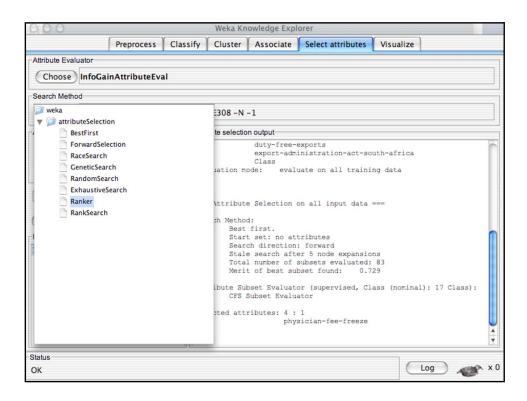
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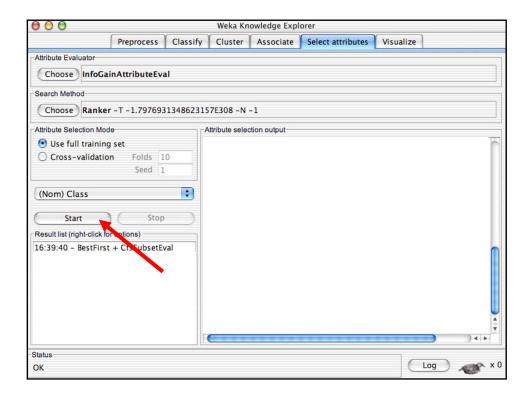
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Result list (right-click for options)	Best first. Start set: no attributes		
16:39:40 – BestFirst + CfsSubsetEval	Search direction: forward Stale search after 5 node expansions Total number of subsets evaluated: 83 Merit of best subset found: 0.729 Attribute Subset Evaluator (supervised, Class (nominal): 17 Class): CFS Subset Evaluator Selected attributes: 4 : 1 physician-fee-freeze		
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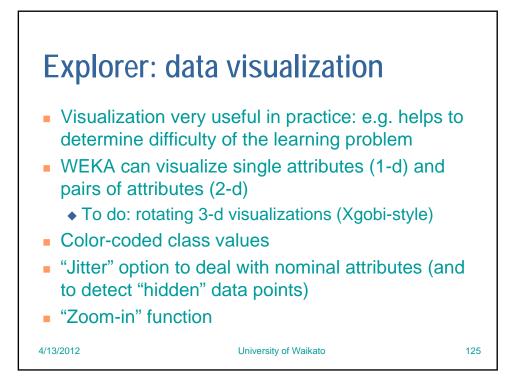
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Result list (right-click for options)	Search Method: Best first. Start set: no attributes Search direction: forward
16:39:40 - BestFirst + CfsSubsetE	xal Stale search direction: forward Stale search after 5 node expansions Total number of subsets evaluated: 83 Merit of best subset found: 0.729
	Attribute Subset Evaluator (supervised, Class (nominal): 17 Class): CFS Subset Evaluator
	Selected attributes: 4 : 1 physician-fee-freeze
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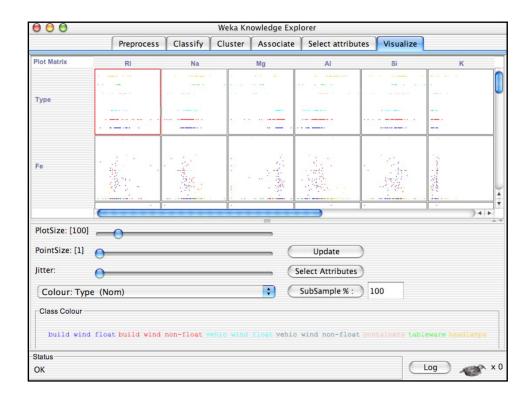


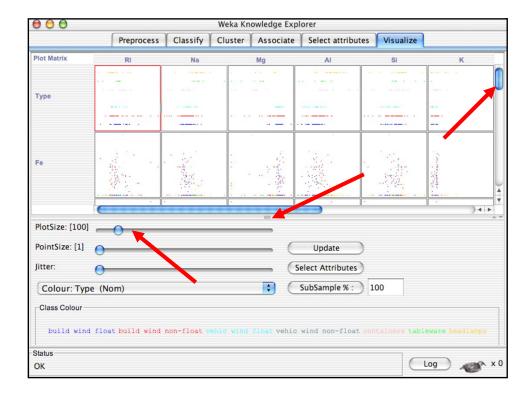


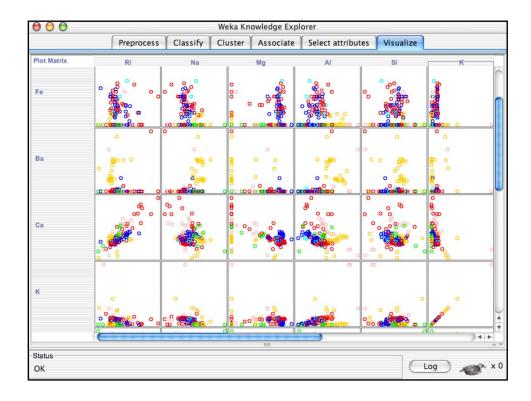
🕽 😑 🕙 Weka Knowledge Explorer			
Preprocess Classi	fy Cluster Associate Select attributes Visualize		
Attribute Evaluator Choose InfoGainAttributeEval Search Method Choose Ranker -T -1.797693134862	3157E308 -N -1		
Attribute Selection Mode	CAttribute selection output		
Vise full training set Cross-validation Folds Seed 10 1 (Nom) Class Start Stop Result list (right-click for options) 16:39:40 - BestFirst + CfsSubsetEval 16:43:05 - Ranker + InfoGainAttributeEval	Information Gain Ranking Filter Ranked attributes: 0.7078541 4 physician-fee-freeze 0.4185726 3 adoption-of-the-budget-resolution 0.4028397 5 el-salvador-aid 0.30305 8 aid-to-nicaraguan-contras 0.285644 9 mx-missile 0.2121705 13 superfund-right-to-sue 0.2013666 15 duty-free-exports 0.1201266 15 duty-free-exports 0.1201267 7 anti-satellite-test-ban 0.1404643 6 religious-groups-in-schools 0.121834 1 handicapped-infants 0.1007458 11 synfuels-corporation-cutback 0.0529556 16 export-administration-act-south-africa 0.0000117 2 water-project-cost-sharing Selected attributes: 4,3,5,12,14,8,9,13,15,7,6,1,11,16,10,2 : 16		
Status OK	Log 💉 x 0		

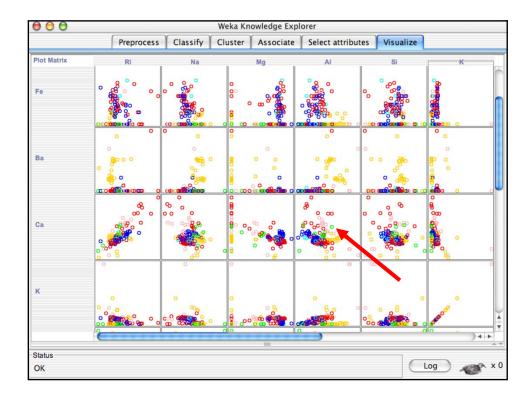


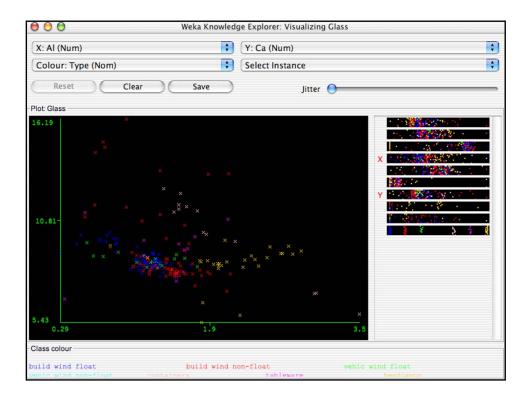
$\Theta \Theta \Theta$	Weka Knowledge Explorer			
	Preprocess Classify Cluster A	Associate Select attributes	Visualize	
Open file	Open URL Ope	en DB Undo	Save	
Filter				
Choose None			Apply	
Current relation Relation: Glass Instances: 214	Attributes: 10	Selected attribute Name: RI Missing: 0 (0%) Distinct:	Type: Numeric 178 Unique: 145 (68%)	
Attributes		Statistic	Value	
No. 1 Rl 2 Na 3 Mg 4 Al 5 Si 6 K	Name	Minimum Maximum Mean StdDev	1.511 1.534 1.518 0.003	
7 Ca 8 Ba 9 Fe 10 Type		Colour: Type (Nom)	Visualize All	
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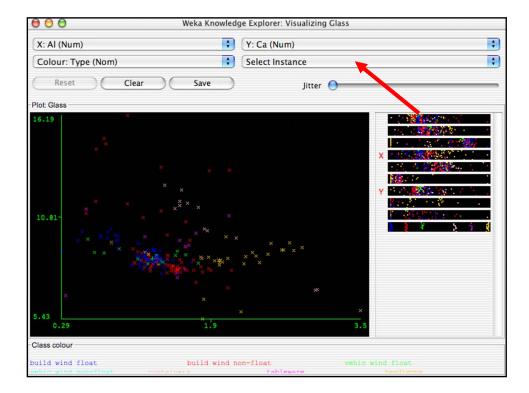


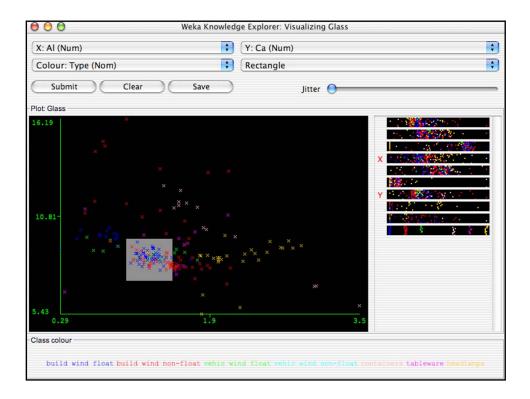


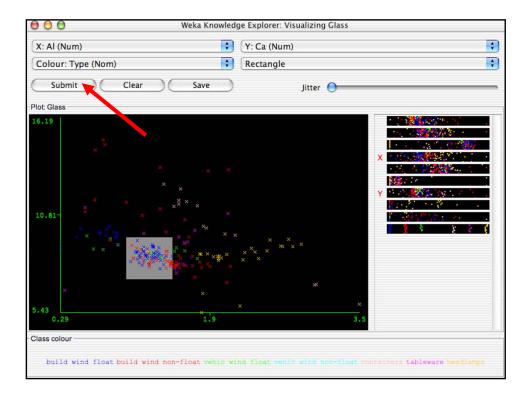


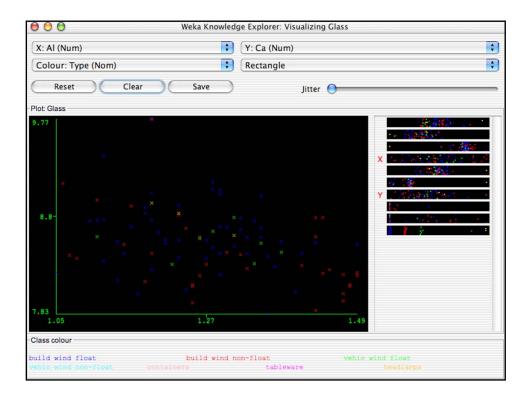


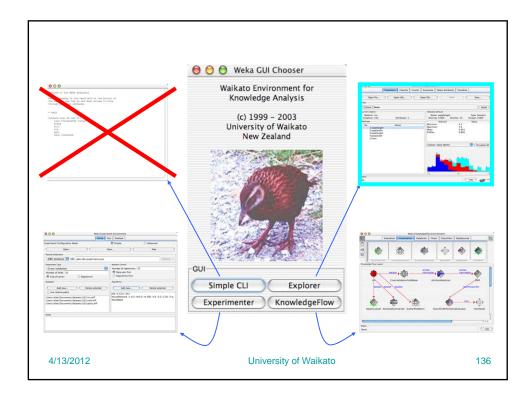


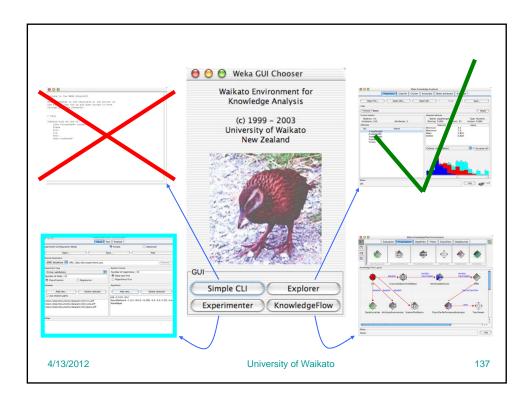


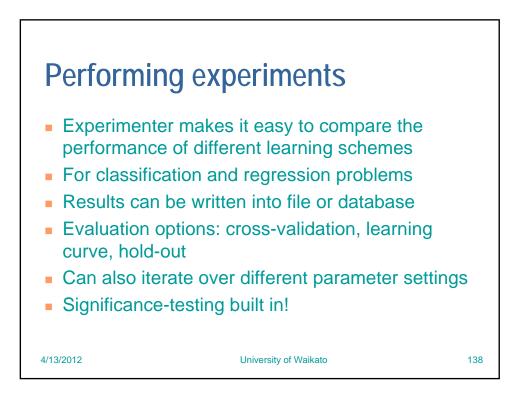












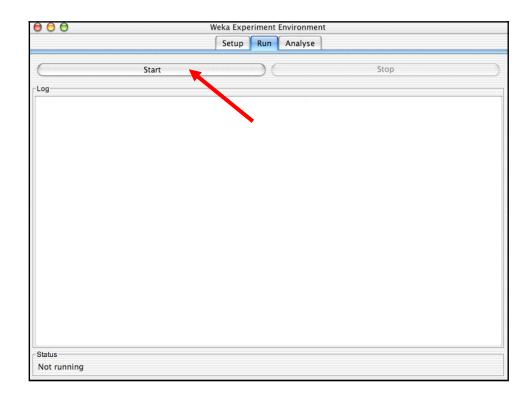
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Classification Classification	 Algorithms first 	
Datasets	Algorithms	
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Notes		
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ent Environment			
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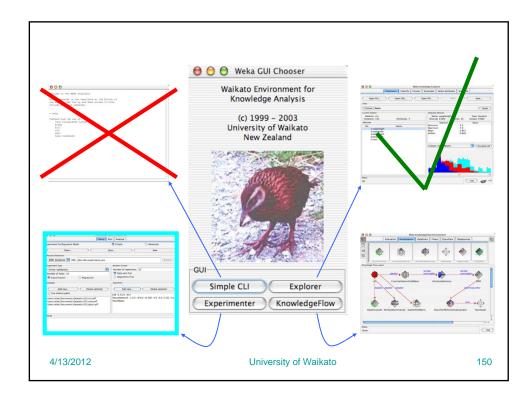
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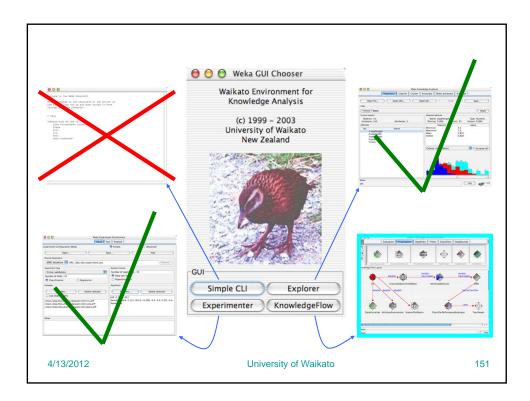
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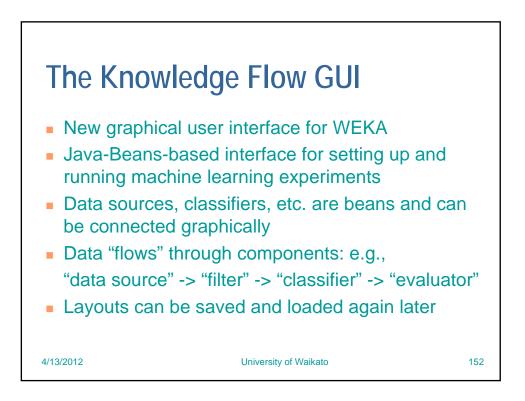
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Show std. deviations			
Perform test	Save output		
Result list			
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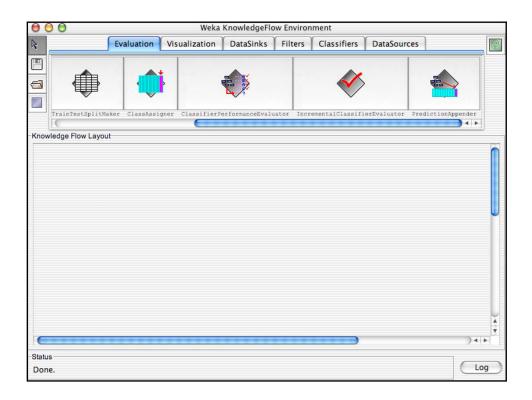
. Database Experiment

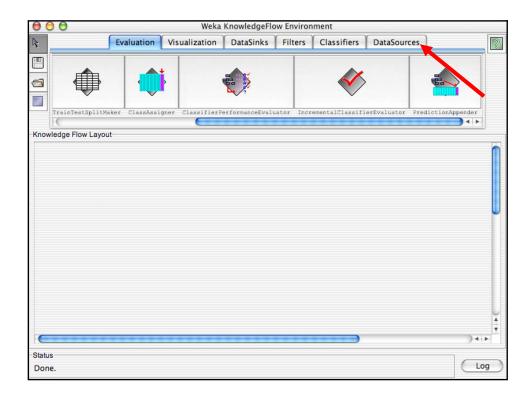
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Got 900 results		File Database Experiment
Configure test	Test output	
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Run field Key_Run	Resultsets: 3 Confidence: 0.05 (two ta Date: 9/9/03 1:44	
Column key fields Select keys	Dataset	(1) trees.j4 (2) funct (3) bayes
Comparison field Percent_correct	iris vote	(100) 94.73 96.4 95.53 (100) 96.57 94.71 * 90.02 *
Significance 0.05	Glass	(100) 67.63 66.78 49.45 *
Test base Select base	Skipped:	(v/ /*) (0/2/1) (0/1/2)
Show std. deviations	Key:	
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13:44:17 - Available resultsets 13:44:55 - Percent_correct - trees.j48.J48 '-C (
) ()

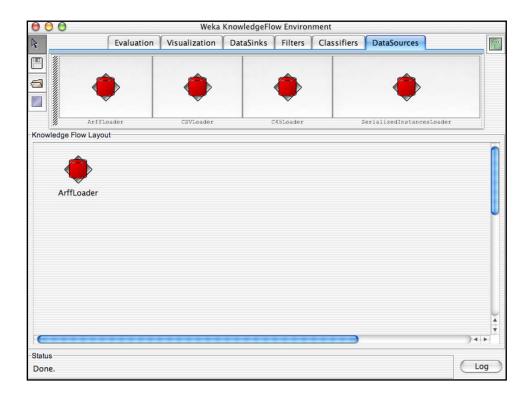


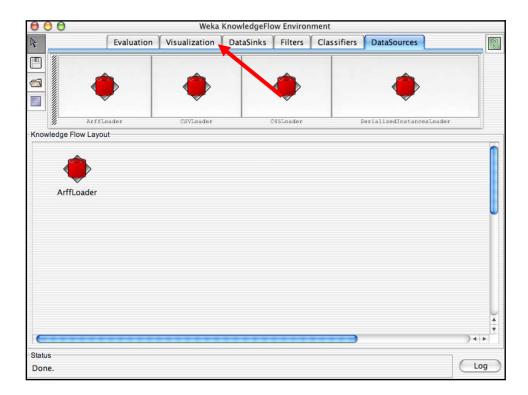








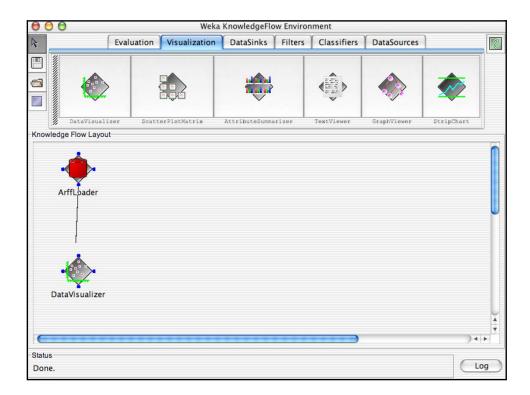


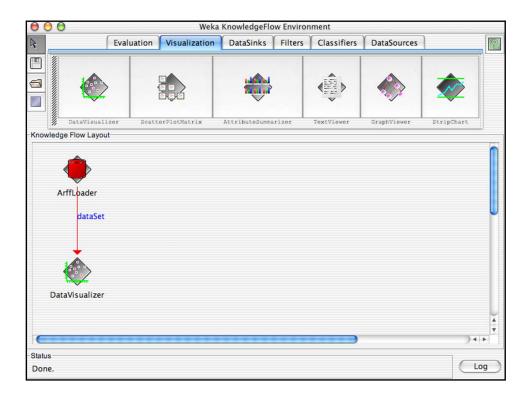


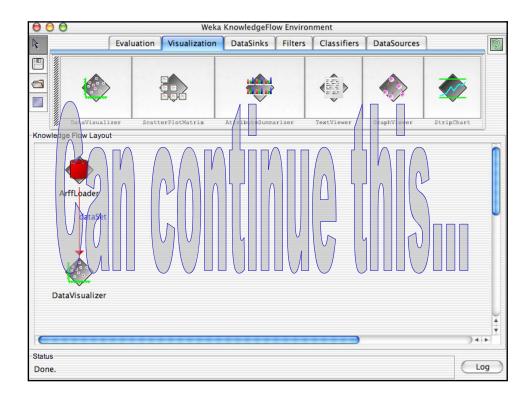
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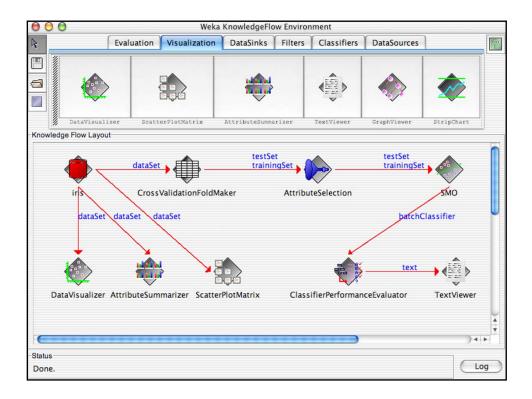
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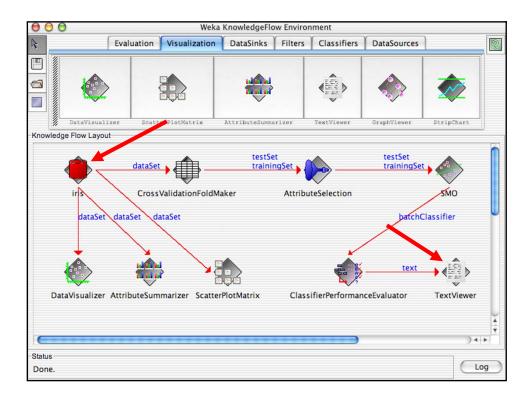
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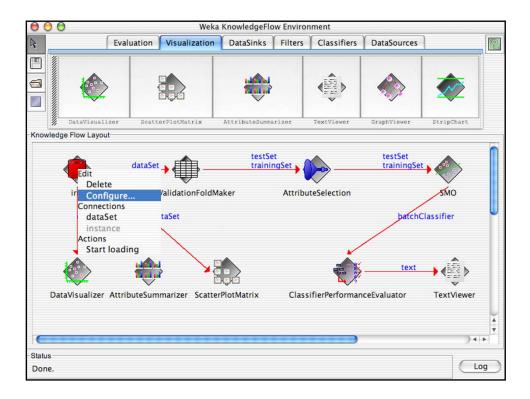


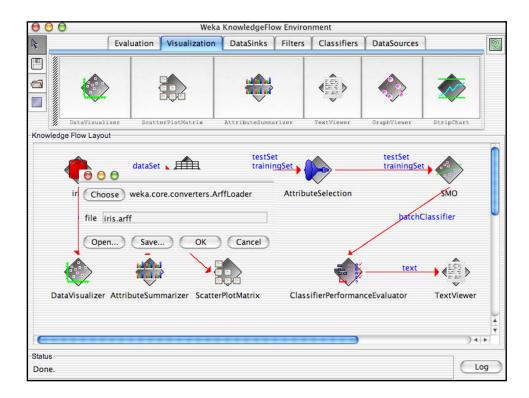


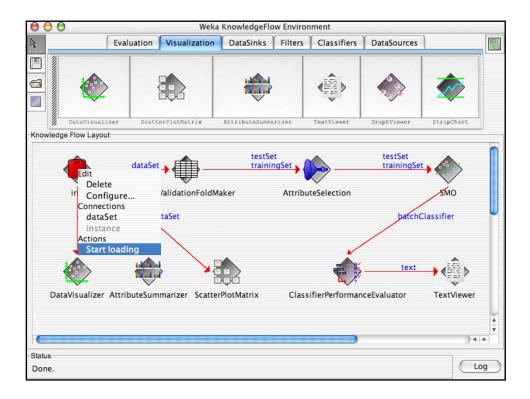


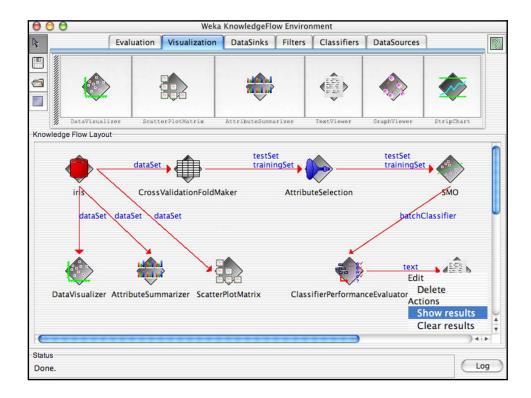












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