

## PREDICTION USING DECISION TREE

=== Run information ===

(J48 -10 Folds)

Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2

Relation: german\_credit

Instances: 1000

Attributes: 21

checking\_status  
duration  
credit\_history  
purpose  
credit\_amount  
savings\_status  
employment  
installment\_commitment  
personal\_status  
other\_parties  
residence\_since  
property\_magnitude  
age  
other\_payment\_plans  
housing  
existing\_credits  
job  
num\_dependents  
own\_telephone  
foreign\_worker  
class

Test mode:10-fold cross-validation

=== Classifier model (full training set) ===

## J48 pruned tree

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checking\_status = <0

| foreign\_worker = yes

| | duration <= 11

| | | existing\_credits <= 1

| | | | property\_magnitude = real estate: good (8.0/1.0)

| | | | property\_magnitude = life insurance

| | | | | own\_telephone = none: bad (2.0)

| | | | | own\_telephone = yes: good (4.0)

| | | | property\_magnitude = car: good (2.0/1.0)

| | | | property\_magnitude = no known property: bad (3.0)

| | | existing\_credits > 1: good (14.0)

| | duration > 11

| | | job = unemp/unskilled non res: bad (5.0/1.0)

| | | job = unskilled resident

| | | | purpose = new car

| | | | | own\_telephone = none: bad (10.0/2.0)

| | | | | own\_telephone = yes: good (2.0)

| | | | purpose = used car: bad (1.0)

| | | | purpose = furniture/equipment

| | | | | employment = unemployed: good (0.0)

| | | | | employment = <1: bad (3.0)

| | | | | employment = 1<=X<4: good (4.0)

| | | | | employment = 4<=X<7: good (1.0)

| | | | | employment = >=7: good (2.0)

| | | | purpose = radio/tv

| | | | | existing\_credits <= 1: bad (10.0/3.0)

| | | | | existing\_credits > 1: good (2.0)

| | | | purpose = domestic appliance: bad (1.0)

| | | | purpose = repairs: bad (1.0)

| | | | purpose = education: bad (1.0)

| | | | purpose = vacation: bad (0.0)

| | | | purpose = retraining: good (1.0)

| | | | purpose = business: good (3.0)

| | | | purpose = other: good (1.0)

| | | job = skilled

| | | | other\_parties = none

| | | | | duration <= 30

| | | | | | savings\_status = <100

| | | | | | | credit\_history = no credits/all paid: bad (8.0/1.0)

| | | | | | | credit\_history = all paid: bad (6.0)

| | | | | | | credit\_history = existing paid

| | | | | | | | own\_telephone = none

| | | | | | | | | existing\_credits <= 1

| | | | | | | | | | property\_magnitude = real estate

| | | | | | | | | | | age <= 26: bad (5.0)

| | | | | | | | | | | age > 26: good (2.0)

| | | | | | | | | | | property\_magnitude = life insurance: bad (7.0/2.0)

| | | | | | | | | | | property\_magnitude = car

| | | | | | | | | | | credit\_amount <= 1386: bad (3.0)

| | | | | | | | | | | credit\_amount > 1386: good (11.0/1.0)

| | | | | | | | | | | property\_magnitude = no known property: good (2.0)

| | | | | | | | | | | existing\_credits > 1: bad (3.0)

| | | | | | | | | | | own\_telephone = yes: bad (5.0)

| | | | | | | | credit\_history = delayed previously: bad (4.0)

| | | | | | | | credit\_history = critical/other existing credit: good (14.0/4.0)

| | | | | | | savings\_status = 100<=X<500

| | | | | | | credit\_history = no credits/all paid: good (0.0)

| | | | | | | credit\_history = all paid: good (1.0)

| | | | | | | credit\_history = existing paid: bad (3.0)  
 | | | | | | | credit\_history = delayed previously: good (0.0)  
 | | | | | | | credit\_history = critical/other existing credit: good (2.0)  
 | | | | | | | savings\_status = 500<=X<1000: good (4.0/1.0)  
 | | | | | | | savings\_status = >=1000: good (4.0)  
 | | | | | | | savings\_status = no known savings  
 | | | | | | | existing\_credits <= 1  
 | | | | | | | | own\_telephone = none: bad (9.0/1.0)  
 | | | | | | | | own\_telephone = yes: good (4.0/1.0)  
 | | | | | | | existing\_credits > 1: good (2.0)  
 | | | | | duration > 30: bad (30.0/3.0)  
 | | | | other\_parties = co applicant: bad (7.0/1.0)  
 | | | | other\_parties = guarantor: good (12.0/3.0)  
 | | | job = high qualif/self emp/mgmt: good (30.0/8.0)  
 | foreign\_worker = no: good (15.0/2.0)  
 checking\_status = 0<=X<200  
 | credit\_amount <= 9857  
 | | savings\_status = <100  
 | | | other\_parties = none  
 | | | | duration <= 42  
 | | | | | personal\_status = male div/sep: bad (8.0/2.0)  
 | | | | | personal\_status = female div/dep/mar  
 | | | | | | purpose = new car: bad (5.0/1.0)  
 | | | | | | purpose = used car: bad (1.0)  
 | | | | | | purpose = furniture/equipment  
 | | | | | | | duration <= 10: bad (3.0)  
 | | | | | | | duration > 10  
 | | | | | | | | duration <= 21: good (6.0/1.0)  
 | | | | | | | | duration > 21: bad (2.0)  
 | | | | | | | purpose = radio/tv: good (8.0/2.0)  
 | | | | | | | purpose = domestic appliance: good (0.0)

| | | | | | purpose = repairs: good (1.0)

| | | | | | purpose = education: good (4.0/2.0)

| | | | | | purpose = vacation: good (0.0)

| | | | | | purpose = retraining: good (0.0)

| | | | | | purpose = business

| | | | | | residence\_since <= 2: good (3.0)

| | | | | | residence\_since > 2: bad (2.0)

| | | | | | purpose = other: good (0.0)

| | | | | personal\_status = male single: good (52.0/15.0)

| | | | | personal\_status = male mar/wid

| | | | | duration <= 10: good (6.0)

| | | | | duration > 10: bad (10.0/3.0)

| | | | | personal\_status = female single: good (0.0)

| | | | duration > 42: bad (7.0)

| | | other\_parties = co applicant: good (2.0)

| | | other\_parties = guarantor

| | | | purpose = new car: bad (2.0)

| | | | purpose = used car: good (0.0)

| | | | purpose = furniture/equipment: good (0.0)

| | | | purpose = radio/tv: good (18.0/1.0)

| | | | purpose = domestic appliance: good (0.0)

| | | | purpose = repairs: good (0.0)

| | | | purpose = education: good (0.0)

| | | | purpose = vacation: good (0.0)

| | | | purpose = retraining: good (0.0)

| | | | purpose = business: good (0.0)

| | | | purpose = other: good (0.0)

| | savings\_status = 100<=X<500

| | | purpose = new car: bad (15.0/5.0)

| | | purpose = used car: good (3.0)

| | | purpose = furniture/equipment: bad (4.0/1.0)

- | | | purpose = radio/tv: bad (8.0/2.0)
- | | | purpose = domestic appliance: good (0.0)
- | | | purpose = repairs: good (2.0)
- | | | purpose = education: good (0.0)
- | | | purpose = vacation: good (0.0)
- | | | purpose = retraining: good (0.0)
- | | | purpose = business
- | | | | housing = rent
- | | | | | existing\_credits <= 1: good (2.0)
- | | | | | existing\_credits > 1: bad (2.0)
- | | | | housing = own: good (6.0)
- | | | | housing = for free: bad (1.0)
- | | | purpose = other: good (1.0)
- | | savings\_status = 500<=X<1000: good (11.0/3.0)
- | | savings\_status = >=1000: good (13.0/3.0)
- | | savings\_status = no known savings: good (41.0/5.0)
- | credit\_amount > 9857: bad (20.0/3.0)
- checking\_status = >=200: good (63.0/14.0)
- checking\_status = no checking: good (394.0/46.0)

Number of Leaves : 103

Size of the tree : 140

Time taken to build model: 0.39 seconds

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	705	70.5 %
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Incorrectly Classified Instances	295	29.5 %
Kappa statistic	0.2467	
Mean absolute error	0.3467	
Root mean squared error	0.4796	
Relative absolute error	82.5233 %	
Root relative squared error	104.6565 %	
Total Number of Instances	1000	

=== Detailed Accuracy By Class ===

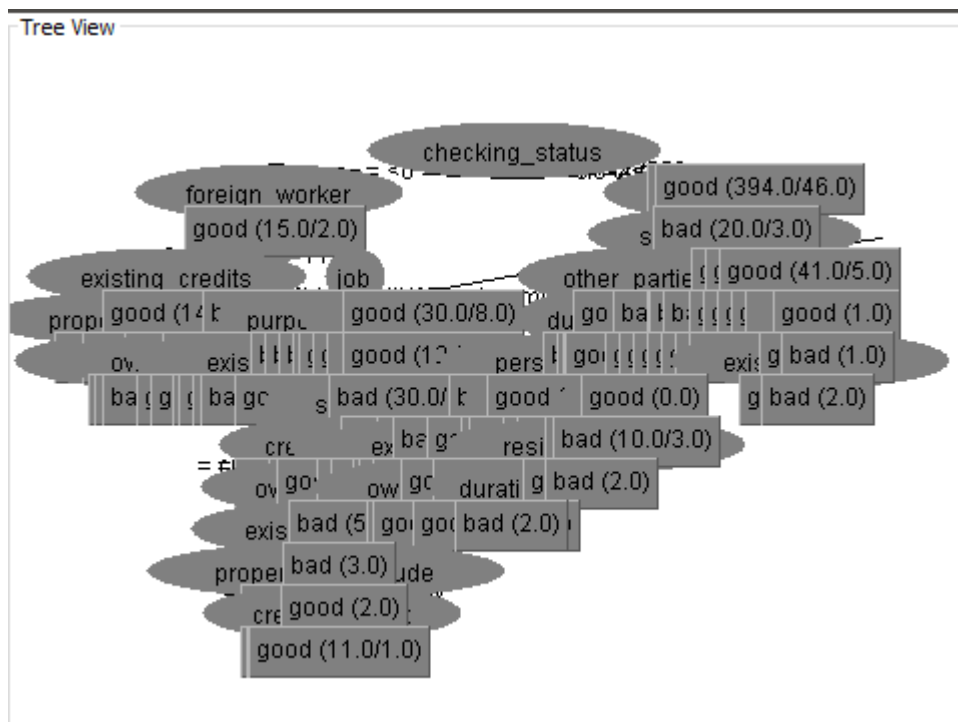
	TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
	0.84	0.61	0.763	0.84	0.799	0.639	good
	0.39	0.16	0.511	0.39	0.442	0.639	bad
Weighted Avg.	0.705	0.475	0.687	0.705	0.692	0.639	

=== Confusion Matrix ===

```

a  b  <-- classified as
588 112 |  a = good
183 117 |  b = bad

```



J48 (5 folds)

=== Run information ===

Scheme:weka.classifiers.trees.J48 -C 0.25 -M 2

Relation: german\_credit

Instances: 1000

Attributes: 21

checking\_status  
duration  
credit\_history  
purpose  
credit\_amount  
savings\_status  
employment  
installment\_commitment  
personal\_status  
other\_parties  
residence\_since



property\_magnitude  
age  
other\_payment\_plans  
housing  
existing\_credits  
job  
num\_dependents  
own\_telephone  
foreign\_worker  
class

Test mode:5-fold cross-validation

=== Classifier model (full training set) ===

J48 pruned tree

-----

```
checking_status = <0
|  foreign_worker = yes
|  |  duration <= 11
|  |  |  existing_credits <= 1
|  |  |  |  property_magnitude = real estate: good (8.0/1.0)
|  |  |  |  property_magnitude = life insurance
|  |  |  |  own_telephone = none: bad (2.0)
|  |  |  |  own_telephone = yes: good (4.0)
|  |  |  |  property_magnitude = car: good (2.0/1.0)
|  |  |  |  property_magnitude = no known property: bad (3.0)
|  |  |  existing_credits > 1: good (14.0)
|  |  duration > 11
|  |  |  job = unemp/unskilled non res: bad (5.0/1.0)
|  |  |  job = unskilled resident
```

| | | | purpose = new car

| | | | | own\_telephone = none: bad (10.0/2.0)

| | | | | own\_telephone = yes: good (2.0)

| | | | purpose = used car: bad (1.0)

| | | | purpose = furniture/equipment

| | | | | employment = unemployed: good (0.0)

| | | | | employment = <1: bad (3.0)

| | | | | employment = 1<=X<4: good (4.0)

| | | | | employment = 4<=X<7: good (1.0)

| | | | | employment = >=7: good (2.0)

| | | | purpose = radio/tv

| | | | | existing\_credits <= 1: bad (10.0/3.0)

| | | | | existing\_credits > 1: good (2.0)

| | | | purpose = domestic appliance: bad (1.0)

| | | | purpose = repairs: bad (1.0)

| | | | purpose = education: bad (1.0)

| | | | purpose = vacation: bad (0.0)

| | | | purpose = retraining: good (1.0)

| | | | purpose = business: good (3.0)

| | | | purpose = other: good (1.0)

| | | job = skilled

| | | | other\_parties = none

| | | | | duration <= 30

| | | | | | savings\_status = <100

| | | | | | | credit\_history = no credits/all paid: bad (8.0/1.0)

| | | | | | | credit\_history = all paid: bad (6.0)

| | | | | | | credit\_history = existing paid

| | | | | | | | own\_telephone = none

| | | | | | | | | existing\_credits <= 1

| | | | | | | | | | property\_magnitude = real estate

| | | | | | | | | | | age <= 26: bad (5.0)

| | | | | | | | | | | age > 26: good (2.0)  
 | | | | | | | | | | | property\_magnitude = life insurance: bad (7.0/2.0)  
 | | | | | | | | | | | property\_magnitude = car  
 | | | | | | | | | | | credit\_amount <= 1386: bad (3.0)  
 | | | | | | | | | | | credit\_amount > 1386: good (11.0/1.0)  
 | | | | | | | | | | | property\_magnitude = no known property: good (2.0)  
 | | | | | | | | | | | existing\_credits > 1: bad (3.0)  
 | | | | | | | | | | | own\_telephone = yes: bad (5.0)  
 | | | | | | | | | | | credit\_history = delayed previously: bad (4.0)  
 | | | | | | | | | | | credit\_history = critical/other existing credit: good (14.0/4.0)  
 | | | | | | | savings\_status = 100<=X<500  
 | | | | | | | | | | | credit\_history = no credits/all paid: good (0.0)  
 | | | | | | | | | | | credit\_history = all paid: good (1.0)  
 | | | | | | | | | | | credit\_history = existing paid: bad (3.0)  
 | | | | | | | | | | | credit\_history = delayed previously: good (0.0)  
 | | | | | | | | | | | credit\_history = critical/other existing credit: good (2.0)  
 | | | | | | | savings\_status = 500<=X<1000: good (4.0/1.0)  
 | | | | | | | savings\_status = >=1000: good (4.0)  
 | | | | | | | savings\_status = no known savings  
 | | | | | | | | | | | existing\_credits <= 1  
 | | | | | | | | | | | own\_telephone = none: bad (9.0/1.0)  
 | | | | | | | | | | | own\_telephone = yes: good (4.0/1.0)  
 | | | | | | | | | | | existing\_credits > 1: good (2.0)  
 | | | | | | | | | | | duration > 30: bad (30.0/3.0)  
 | | | | | | | | | | | other\_parties = co applicant: bad (7.0/1.0)  
 | | | | | | | | | | | other\_parties = guarantor: good (12.0/3.0)  
 | | | | | | | | | | | job = high qualif/self emp/mgmt: good (30.0/8.0)  
 | | | | | | | | | | | foreign\_worker = no: good (15.0/2.0)  
 checking\_status = 0<=X<200  
 | | | | | | | | | | | credit\_amount <= 9857  
 | | | | | | | | | | | savings\_status = <100

| | | other\_parties = none

| | | | duration <= 42

| | | | | personal\_status = male div/sep: bad (8.0/2.0)

| | | | | personal\_status = female div/dep/mar

| | | | | | purpose = new car: bad (5.0/1.0)

| | | | | | purpose = used car: bad (1.0)

| | | | | | purpose = furniture/equipment

| | | | | | | duration <= 10: bad (3.0)

| | | | | | | duration > 10

| | | | | | | | duration <= 21: good (6.0/1.0)

| | | | | | | | duration > 21: bad (2.0)

| | | | | | | purpose = radio/tv: good (8.0/2.0)

| | | | | | | purpose = domestic appliance: good (0.0)

| | | | | | | purpose = repairs: good (1.0)

| | | | | | | purpose = education: good (4.0/2.0)

| | | | | | | purpose = vacation: good (0.0)

| | | | | | | purpose = retraining: good (0.0)

| | | | | | | purpose = business

| | | | | | | residence\_since <= 2: good (3.0)

| | | | | | | residence\_since > 2: bad (2.0)

| | | | | | | purpose = other: good (0.0)

| | | | | | personal\_status = male single: good (52.0/15.0)

| | | | | | personal\_status = male mar/wid

| | | | | | | duration <= 10: good (6.0)

| | | | | | | duration > 10: bad (10.0/3.0)

| | | | | | personal\_status = female single: good (0.0)

| | | | | | duration > 42: bad (7.0)

| | | | other\_parties = co applicant: good (2.0)

| | | | other\_parties = guarantor

| | | | | purpose = new car: bad (2.0)

| | | | | purpose = used car: good (0.0)

- | | | | purpose = furniture/equipment: good (0.0)
- | | | | purpose = radio/tv: good (18.0/1.0)
- | | | | purpose = domestic appliance: good (0.0)
- | | | | purpose = repairs: good (0.0)
- | | | | purpose = education: good (0.0)
- | | | | purpose = vacation: good (0.0)
- | | | | purpose = retraining: good (0.0)
- | | | | purpose = business: good (0.0)
- | | | | purpose = other: good (0.0)
- | | savings\_status = 100<=X<500
- | | | purpose = new car: bad (15.0/5.0)
- | | | purpose = used car: good (3.0)
- | | | purpose = furniture/equipment: bad (4.0/1.0)
- | | | purpose = radio/tv: bad (8.0/2.0)
- | | | purpose = domestic appliance: good (0.0)
- | | | purpose = repairs: good (2.0)
- | | | purpose = education: good (0.0)
- | | | purpose = vacation: good (0.0)
- | | | purpose = retraining: good (0.0)
- | | | purpose = business
- | | | | housing = rent
- | | | | | existing\_credits <= 1: good (2.0)
- | | | | | existing\_credits > 1: bad (2.0)
- | | | | housing = own: good (6.0)
- | | | | housing = for free: bad (1.0)
- | | | purpose = other: good (1.0)
- | | savings\_status = 500<=X<1000: good (11.0/3.0)
- | | savings\_status = >=1000: good (13.0/3.0)
- | | savings\_status = no known savings: good (41.0/5.0)
- | credit\_amount > 9857: bad (20.0/3.0)
- checking\_status = >=200: good (63.0/14.0)

checking\_status = no checking: good (394.0/46.0)

Number of Leaves : 103

Size of the tree : 140

Time taken to build model: 0.05 seconds

=== Stratified cross-validation ===

=== Summary ===

Correctly Classified Instances	733	73.3 %
Incorrectly Classified Instances	267	26.7 %
Kappa statistic	0.3264	
Mean absolute error	0.3293	
Root mean squared error	0.4579	
Relative absolute error	78.3705 %	
Root relative squared error	99.914 %	
Total Number of Instances	1000	

=== Detailed Accuracy By Class ===

	TP Rate	FP Rate	Precision	Recall	F-Measure	ROC Area	Class
	0.851	0.543	0.785	0.851	0.817	0.685	good
	0.457	0.149	0.568	0.457	0.506	0.685	bad
Weighted Avg.	0.733	0.425	0.72	0.733	0.724	0.685	

=== Confusion Matrix ===

a b <-- classified as

```
163 137 | b = bad
```

