

UNIVERSITAT POLITÈCNICA DE CATALUNYA

Departament d'Enginyeria de Sistemes, Automàtica i Informàtica Industrial

**Mètode d'Extracció Multiparamètrica
de Característiques de Textura
Orientat a la Segmentació d'imatges**

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APÈNDIX A.

En aquest apèndix es mostra el resultat de l'aplicació de l'algorisme STEPDISC per a l'anàlisi discriminant. L'algorisme s'ha aplicat seguint tres mètodes: *stepwise*, *forward* i *backward*. Amb tots tres mètodes s'ha arribat a la mateixa conclusió: no es pot eliminar cap variable del sistema de paràmetres de textura. Tots els paràmetres aporten informació rellevant per a la discriminació dels grups de textura.

A continuació es mostren els resultats d'aplicar els tres mètodes. En els resultats del punt A.1 hi ha també les matrius de covariància entre classes, els coeficients de correlació entre classes, la matriu de covariància total de mostres i també els coeficients de correlació totals entre mostres.

A.1. Mètode de selecció de variables: STEPWISE.

Imatges de Brodatz

Stepwise Discriminant Analysis

26624 Observations 5 Variable(s) in the Analysis
26 Class Levels 0 Variable(s) will be included

The Method for Selecting Variables will be: STEPWISE

Significance Level to Enter = 0.1500

Significance Level to Stay = 0.1500

Stepwise Discriminant Analysis

Class Level Information

IMATGE	Frequency	Weight	Proportion
1	1024	1024	0.038462
2	1024	1024	0.038462
3	1024	1024	0.038462
4	1024	1024	0.038462
5	1024	1024	0.038462
6	1024	1024	0.038462
7	1024	1024	0.038462
8	1024	1024	0.038462
9	1024	1024	0.038462
10	1024	1024	0.038462
11	1024	1024	0.038462
12	1024	1024	0.038462
13	1024	1024	0.038462
14	1024	1024	0.038462
15	1024	1024	0.038462
16	1024	1024	0.038462
17	1024	1024	0.038462
18	1024	1024	0.038462
19	1024	1024	0.038462
20	1024	1024	0.038462
21	1024	1024	0.038462
22	1024	1024	0.038462
23	1024	1024	0.038462
24	1024	1024	0.038462
25	1024	1024	0.038462
26	1024	1024	0.038462

Total-Sample SSCP Matrix

Variable	GRANU	LINIA	DIFU	
GRANU	6847740.0	-4277291.1	-4836643.1	Granulositat
LINIA	-4277291.1	96076960.0	-34277397.1	Linealitat
DIFU	-4836643.1	-34277397.1	93954734.5	Difuminat
ABRUP	199747.7	-5995030.6	-10983752.3	Abruptitat
DISCON	-5623721.3	85133932.3	-25409767.6	Discontinuitat

Variable	ABRUP	DISCON	
GRANU	199747.7	-5623721.3	Granulositat
LINIA	-5995030.6	85133932.3	Linealitat
DIFU	-10983752.3	-25409767.6	Difuminat
ABRUP	23666533.4	-7907601.8	Abruptitat
DISCON	-7907601.8	125936469.3	Discontinuitat

Total-Sample Covariance Matrix DF = 26623

Variable	GRANU	LINIA	DIFU	
GRANU	257.211435	-160.661499	-181.671603	Granulositat
LINIA	-160.661499	3608.795401	-1287.510689	Linealitat
DIFU	-181.671603	-1287.510689	3529.081416	Difuminat
ABRUP	7.502826	-225.182385	-412.566290	Abruptitat
DISCON	-211.235446	3197.758790	-954.429164	Discontinuitat

Variable	ABRUP	DISCON	
GRANU	7.502826	-211.235446	Granulositat
LINIA	-225.182385	3197.758790	Linealitat
DIFU	-412.566290	-954.429164	Difuminat
ABRUP	888.950661	-297.021440	Abruptitat
DISCON	-297.021440	4730.363571	Discontinuitat

Total-Sample Correlation Coefficients / Prob > |R|

Variable	GRANU	LINIA	DIFU	ABRUP	DISCON
GRANU	1.00000	-0.16676	-0.19068	0.01569	-0.19150
Granulositat	0.0	0.0001	0.0001	0.0105	0.0001
LINIA	-0.16676	1.00000	-0.36078	-0.12572	0.77396
Linealitat	0.0001	0.0	0.0001	0.0001	0.0001
DIFU	-0.19068	-0.36078	1.00000	-0.23293	-0.23360
Difuminat	0.0001	0.0001	0.0	0.0001	0.0001
ABRUP	0.01569	-0.12572	-0.23293	1.00000	-0.14484
Abruptitat	0.0105	0.0001	0.0001	0.0	0.0001
DISCON	-0.19150	0.77396	-0.23360	-0.14484	1.00000
Discontinuitat	0.0001	0.0001	0.0001	0.0001	0.0

Stepwise Selection: Step 1

Statistics for Entry, DF = 25, 26598

Variable	R**2	F	Prob > F	Tolerance	Label
GRANU	0.0939	110.276	0.0001	1.0000	Granulositat
LINIA	0.4470	859.886	0.0001	1.0000	Linealitat
DIFU	0.7701	3564.134	0.0001	1.0000	Difuminat
ABRUP	0.1435	178.317	0.0001	1.0000	Abruptitat
DISCON	0.4180	764.102	0.0001	1.0000	Discontinuitat

Variable DIFU will be entered

The following variable(s) have been entered:
DIFU

Stepwise Selection: Step 1

Multivariate Statistics

Wilks' Lambda = 0.22988497 F(25, 26598) = 3564.134
 Prob > F = 0.0001
 Pillai's Trace = 0.770115 F(25, 26598) = 3564.134
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.03080460

Stepwise Selection: Step 2

Statistics for Removal, DF = 25, 26598

Variable	R**2	F	Prob > F	Label
DIFU	0.7701	3564.134	0.0001	Difuminat

No variables can be removed

Stepwise Selection: Step 2

Statistics for Entry, DF = 25, 26597

Variable	Partial R**2	F	Prob > F	Tolerance	Label
GRANU	0.0615	69.676	0.0001	0.9636	Granulositat
LINIA	0.3860	668.748	0.0001	0.8698	Linealitat
ABRUP	0.0990	116.890	0.0001	0.9457	Abruptitat
DISCON	0.3940	691.811	0.0001	0.9454	Discontinuitat

Variable DISCON will be entered

The following variable(s) have been entered:

DIFU DISCON

Stepwise Selection: Step 2

Multivariate Statistics

Wilks' Lambda = 0.13930132 F(50, 53194) = 1786.581
 Prob > F = 0.0001
 Pillai's Trace = 1.163864 F(50, 53196) = 1480.930
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.04655457

Stepwise Selection: Step 3

Statistics for Removal, DF = 25, 26597

Variable	Partial R**2	F	Prob > F	Label
DIFU	0.7607	3381.051	0.0001	Difuminat
DISCON	0.3940	691.811	0.0001	Discontinuitat

No variables can be removed

Stepwise Selection: Step 3

Statistics for Entry, DF = 25, 26596

Variable	Partial R**2	F	Prob > F	Tolerance	Label
GRANU	0.0755	86.826	0.0001	0.8876	Granulositat
LINIA	0.3954	695.639	0.0001	0.3667	Linealitat
ABRUP	0.1154	138.766	0.0001	0.8727	Abruptitat

Variable LINIA will be entered

The following variable(s) have been entered:
 LINIA DIFU DISCON

Stepwise Selection: Step 3

Multivariate Statistics

Wilks' Lambda = 0.08422625 F(75, 79506) = 1365.393
 Prob > F = 0.0001
 Pillai's Trace = 1.316189 F(75, 79794) = 831.637
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.05264756

Stepwise Selection: Step 4

Statistics for Removal, DF = 25, 26596

Variable	Partial R**2	F	Prob > F	Label
LINIA	0.3954	695.639	0.0001	Linealitat
DIFU	0.7805	3782.191	0.0001	Difuminat
DISCON	0.4033	719.059	0.0001	Discontinuitat

No variables can be removed

Stepwise Selection: Step 4

Statistics for Entry, DF = 25, 26595

Variable	Partial R**2	F	Prob > F	Tolerance	Label
GRANU	0.1221	147.977	0.0001	0.3623	Granulositat
ABRUP	0.1759	227.082	0.0001	0.3621	Abruptitat

Variable ABRUP will be entered

The following variable(s) have been entered:
 LINIA DIFU ABRUP DISCON

Stepwise Selection: Step 4

Multivariate Statistics

Wilks' Lambda = 0.06940982 F(100, 105437) = 1012.128
 Prob > F = 0.0001
 Pillai's Trace = 1.442698 F(100, 106392) = 600.209
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.05770791

Stepwise Selection: Step 5

Statistics for Removal, DF = 25, 26595

Variable	Partial R**2	F	Prob > F	Label
LINIA	0.4367	824.831	0.0001	Linealitat
DIFU	0.7594	3357.023	0.0001	Difuminat
ABRUP	0.1759	227.082	0.0001	Abruptitat
DISCON	0.4032	718.647	0.0001	Discontinuitat

No variables can be removed

Stepwise Selection: Step 5

Statistics for Entry, DF = 25, 26594

Partial

Variable	R**2	F	Prob > F	Tolerance	Label
GRANU	0.1843	240.423	0.0001	0.3568	Granulositat

Variable GRANU will be entered

All variables have been entered

Stepwise Selection: Step 5

Multivariate Statistics

Wilks' Lambda = 0.05661428 F(125, 130880) = 829.554
 Prob > F = 0.0001
 Pillai's Trace = 1.544073 F(125, 132990) = 475.348
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.06176290

Stepwise Selection: Step 6

Statistics for Removal, DF = 25, 26594

Variable	Partial R**2	F	Prob > F	Label
GRANU	0.1843	240.423	0.0001	Granulositat
LINIA	0.4878	1013.076	0.0001	Linealitat
DIFU	0.7386	3005.374	0.0001	Difuminat
ABRUP	0.2343	325.560	0.0001	Abruptitat
DISCON	0.3988	705.720	0.0001	Discontinuitat

No variables can be removed

No further steps are possible

Stepwise Selection: Summary

Step	Variable Entered	Variable Removed	Number In	Partial R**2	F Statistic	Prob > F
1	DIFU		1	0.7701	3564.134	0.0001
2	DISCON		2	0.3940	691.811	0.0001
3	LINIA		3	0.3954	695.639	0.0001
4	ABRUP		4	0.1759	227.082	0.0001
5	GRANU		5	0.1843	240.423	0.0001

Stepwise Selection: Summary

Step	Variable Entered	Variable Removed	Number In	Wilks' Lambda	Prob < Lambda
1	DIFU		1	0.22988497	0.0001
2	DISCON		2	0.13930132	0.0001
3	LINIA		3	0.08422625	0.0001
4	ABRUP		4	0.06940982	0.0001
5	GRANU		5	0.05661428	0.0001

Stepwise Selection: Summary

Step	Variable Entered	Variable Removed	Number In	Average Squared Canonical Correlation	Prob > ASCC	Label
1	DIFU		1	0.03080460	0.0001	Difuminat
2	DISCON		2	0.04655457	0.0001	Discontinuitat
3	LINIA		3	0.05264756	0.0001	Linealitat
4	ABRUP		4	0.05770791	0.0001	Abruptitat
5	GRANU		5	0.06176290	0.0001	Granulositat

GRANU	0.0755	86.826	0.0001	0.8876	Granulositat
LINIA	0.3954	695.639	0.0001	0.3667	Linealitat
ABRUP	0.1154	138.766	0.0001	0.8727	Abruptitat

Variable LINIA will be entered

The following variable(s) have been entered:

LINIA DIFU DISCON

Forward Selection: Step 3

Multivariate Statistics

Wilks' Lambda = 0.08422625 F(75, 79506) = 1365.393
 Prob > F = 0.0001
 Pillai's Trace = 1.316189 F(75, 79794) = 831.637
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.05264756

Forward Selection: Step 4

Statistics for Entry, DF = 25, 26595

Variable	Partial R**2	F	Prob > F	Tolerance	Label
GRANU	0.1221	147.977	0.0001	0.3623	Granulositat
ABRUP	0.1759	227.082	0.0001	0.3621	Abruptitat

Variable ABRUP will be entered

The following variable(s) have been entered:

LINIA DIFU ABRUP DISCON

Forward Selection: Step 4

Multivariate Statistics

Wilks' Lambda = 0.06940982 F(100, 105437) = 1012.128
 Prob > F = 0.0001
 Pillai's Trace = 1.442698 F(100, 106392) = 600.209
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.05770791

Forward Selection: Step 5

Statistics for Entry, DF = 25, 26594

Variable	Partial R**2	F	Prob > F	Tolerance	Label
GRANU	0.1843	240.423	0.0001	0.3568	Granulositat

Variable GRANU will be entered

All variables have been entered

Forward Selection: Step 5

Multivariate Statistics

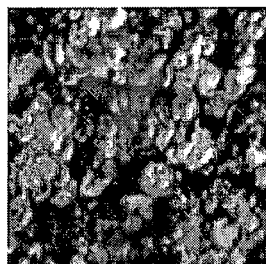
Wilks' Lambda = 0.05661428 F(125, 130880) = 829.554
 Prob > F = 0.0001
 Pillai's Trace = 1.544073 F(125, 132990) = 475.348
 Prob > F = 0.0001

Average Squared Canonical Correlation = 0.06176290

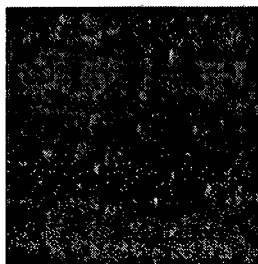
No further steps are possible

APÈNDIX B.

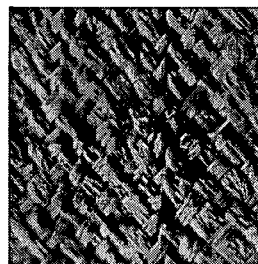
Conjunt d'imatges de Brodatz [BRO66] usades en l'experiment de l'anàlisi discriminant i en l'experiment d'elecció de paràmetres de textura. Aquest conjunt d'imatges és àmpliament usat en molts experiments d'anàlisi de textures i generalment acceptat com a conjunt de proves.



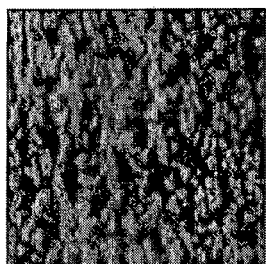
D28



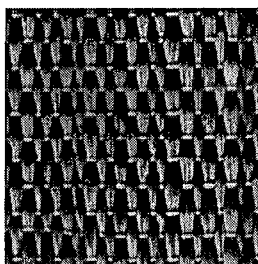
D29



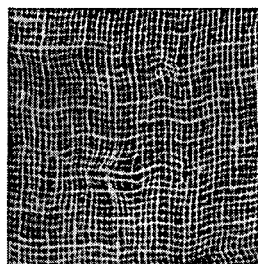
D84



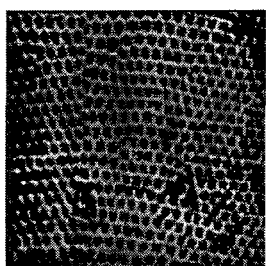
D24



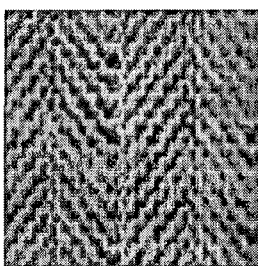
D15



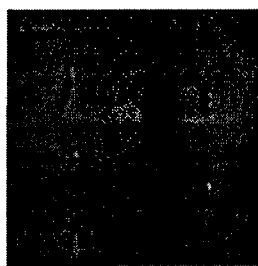
D103



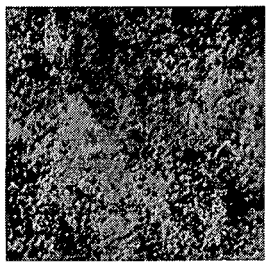
D22



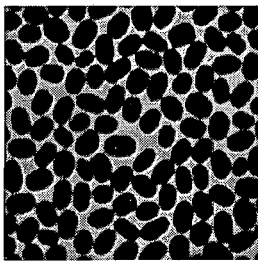
D16



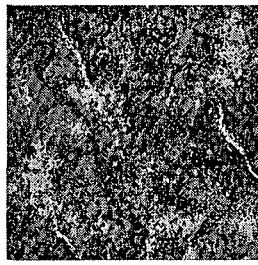
D32



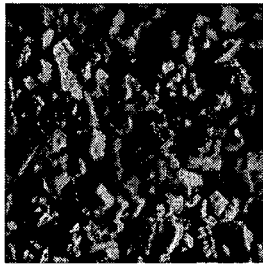
D100



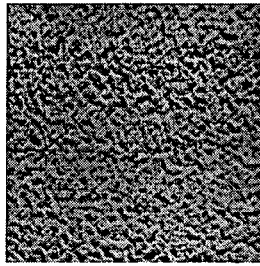
D74



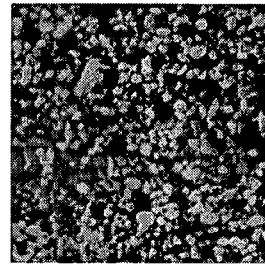
D59



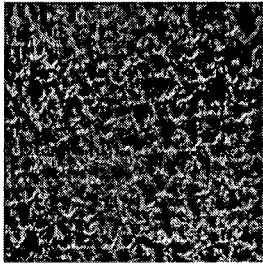
D5



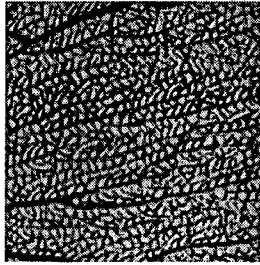
D109



D54



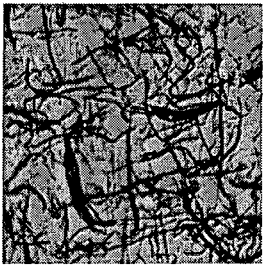
D92



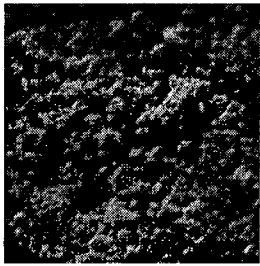
D87



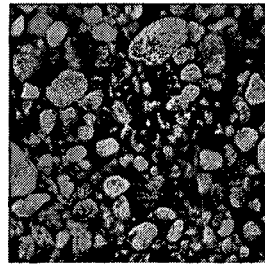
D72



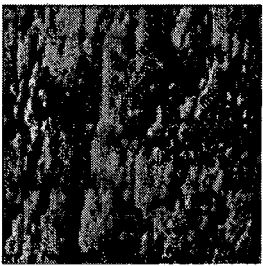
D108



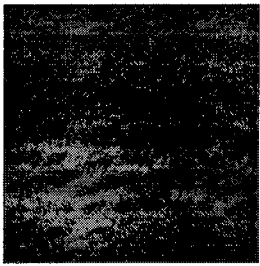
D2



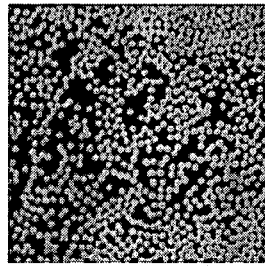
D23



D12



D38



D67

Cada fotografia té un nom i un número. Així doncs, quan s'utilitzen les imatges en qualsevol experiment només cal citar la lletra i el número per referir-se a una imatge en concret. El número associat a cada fotografia correspon a la pàgina del llibre en la qual apareixen.

En la següent taula es pot veure el nom que reb cadascuna de les fotografies anteriors en l'àlbum de Brodatz, tal i com l'autor les va nomenar.

Nom de la imatge de textura	Número de la imatge
Beach Sand	D28
Beach Sand	D29
Raffia	D84
Leather	D24
Straw	D15
Burlap	D103
Reptile	D22
Herringbone weave	D16
Cork	D32
Grass	D9
Ice	D100
Beans	D74
Marble	D59
Mica	D5
Paper	D109
Beach Pebbles	D54
Pig	D92
Sea fan	D87
Tree	D72
Ricepaper	D108
Fieldstone	D2
Beach Pebbles	D23
Barktree	D12
Water	D38
Pellets	D67