

Pattern Recognition Techniques



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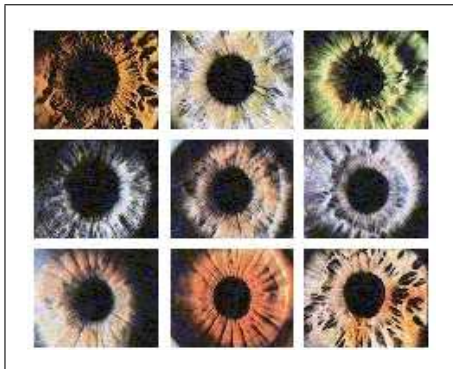
Pattern Recognition Techniques

Course Presentation Syllabus

Seminars

TRP Course Presentation

TRP: 2009-2010



TRP Course Online

- ▶ Course url
 - ▶ <http://www.dei.uc.pt>
 - ▶ <http://classes.dei.uc.pt/>
- ▶ Mailing list: trp@dei.uc.pt
- ▶ Office Hours: Thu 14h - 16h

Course Working Model

- ▶ Theoretical Classes: 30 contact hours (2 hrs/week; 1,11 ECTS)
- ▶ Seminars and Assessment (102 additional hrs; 3,78 ECTS)
- ▶ Lab Practical Classes 30 contact hours (2 hrs/week; 1,11 ECTS)

Learning Goals

- ▶ Knowledge and Comprehension:
 1. Knowledge of several PR Techniques:
 2. Feature Extraction and Selection
 3. Clustering
 4. Neural Networks (supervised and unsupervised)
 5. Support Vector Machines
- ▶ Knowledge Application
 1. Capacity of development of new models/algorithms for real applications.
- ▶ Judgment and Decision :
 1. Capacity of integration of acquired knowledge able to be applied in real scenarios (Medicine, Internet, Finance and Economy, Industry, ..)
- ▶ Communication Skills:
 1. Written Component (Exam/Reports)
 2. Oral Component (Presentation of seminars, Project oral defense)

Course Contents

► Program

1. Introduction to Pattern Recognition Techniques
2. Statistical Methods for Classification
3. Feature Extraction and Selection
4. Pattern Discrimination
5. Clustering
6. Neural Networks
7. Support Vector Machines
8. Syntactical Recognition

Course Assessment

► Competence Assessment:

40% Final Project Grade

1. 40% (8/20)
2. 2 students/Project (at most)
3. 5/20 Project (Work + Written Report)
4. 3/20 Project Defense (t.b.a.)
5. Minimum 35%

► Seminar Assessment

30% (6 / 20)

1. One student/seminar (starting 6th Week) (t.b.a.)
2. 30 min, 10 min discussion

► Knowledge Assessment:

30% (6/20) Final Written Exam

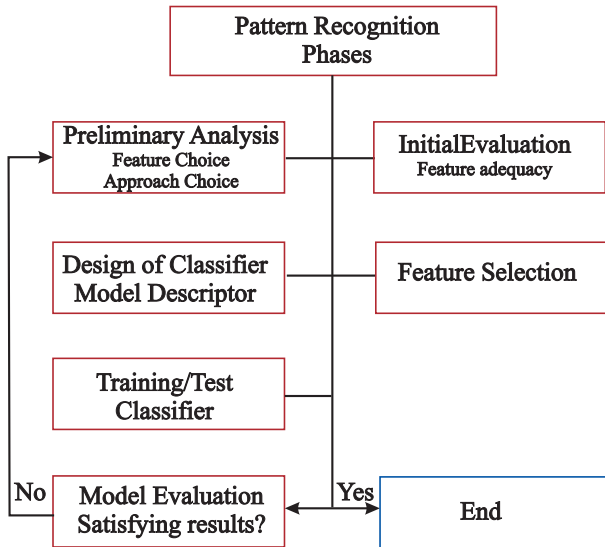
1. W/ Classes Material Consultation, duration: 2hrs
2. Minimum 35%

Pattern Recognition (PR) Project (1)



- ▶ Pattern Recognition Design and Implementation
- ▶ Platform /Matlab/Python/Weka/ ...
- ▶ Interface Pattern Recognition ?

Pattern Recognition (PR) Project (2)



Pattern Recognition (PR) Project (3)

- ▶ Project Evaluation indicators:
 - ▶ Oral presentation
 - ▶ System architecture
 - ▶ Classifier used
 - ▶ Performance and results comparison
 - ▶ Graphical Model Inspection (ROC Curves, ...)
 - ▶ Active participation in the activities of Moodle


TRP Estimation Effort

Table: Effort Cost

Activity	Working (hrs)
Specification, System Architecture (modules)	20
Clustering Techniques (T)	10
Statistical Techniques for Classification (T)	25
Supervised/Unsupervised Techniques (T)	35
Structural Pattern Recognition Techniques (T)	12
Integration, Tests, Reports and Final Project Defense	35
Seminar Preparation	10
Study for Final Exam	15
Total Work hrs	162
ECTS	6




Software Links

Table: Tools Links

Material	Links
Libraries in C	–
Weka 3.4 (Java)	http://www.cs.waikato.ac.nz/ml/weka/
Matlab 7.0 (ToolBoxes)	DEI-Lab
PRTools	http://www.prtools.org/
NETLAB	http://www.ncrg.aston.ac.uk/netlab/index.php
STPRtool	http://cmp.felk.cvut.cz/cmp/software/stprtool
PRtools	Book CD 





Bibliography (1)

Table: Course Books

Book	Description
	Pattern Recognition Concepts, Methods and Applications, Marques de Sá, J.P., 2001
	Pattern Classification, Duda, R. O., Hart, P.E., Stork, D., Wiley Interscience, 2001
	Computer Manual in MATLAB for Pattern Classification, D. Stork, E. Yom, Wiley Interscience, 2001

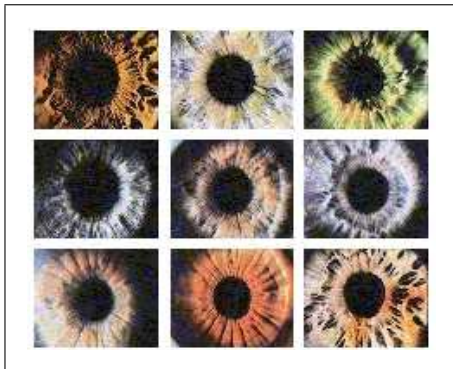
Bibliography (2)

Table: Course Books

Book	Description
	Pattern Recognition and Machine Learning, Bishop, C.M.,2006, Springer Verlag
	Artificial Neural Networks:An Introduction, K. Priddy, P. Keller, 2005
	Top Ten Algorithms in Data Mining, X Wu, V.Kumar, 2009
	Reconhecimento de Padrões: Métodos Estatísticos e Neurais,

Course Seminars

TRP: 2009-2010



Seminar Learning Goals

- ▶ Communication Skills
 - ▶ Seminar presentation slides
 - ▶ Seminar oral presentation and discussion
- ▶ Learning Skills
 - ▶ Autonomous and self-oriented learning in the area of pattern recognition

Seminar Presentation

- ▶ Short summary of the talk
- ▶ Describe Technique
- ▶ Give an example, if available, using the data sets distributed with the course book
- ▶ Present the results
- ▶ Discuss Results
- ▶ Give References

Seminar Preparation

- ▶ Assignment of seminars to each student will be done (by choice or randomly)
- ▶ On the basis of the given materials (and other searched) each student:
 - ▶ Should prepare a class with the seminar (30 min presentation + 10 min discussion)
 - ▶ Produce materials: prepare 15 to 20 Slides (± 5)
 - ▶ Dinamize discussions about the theme (Moodle Forum)
 - ▶ URL do Moodle: <http://moodle.dei.uc.pt>
 - ▶ Enrollment key in Moodle: TRP0910

How Do Seminar Work?

- ▶ In each class fill the scoring graduate seminar rating sheet and deliver to me at the end of class
- ▶ To elaborate a critical comment to the seminar presented by a colleague
 - ▶ Attend the respective class
 - ▶ Read supporting material and discussions promoted by the target student(s)
 - ▶ Elaborate a comment with critical (strong + weak) points, filling the provided rating sheet with assigned scores

Seminars Assessment

- ▶ Presentation in class:

50% 3.0/6.0

- ▶ Participation in the Moodle Forum:

25% 1.5/6.0

- ▶ Critical comments (positive aspects + negative aspects) to two colleagues:

25% 1.5/6.0

Seminars Calender (1)

- ▶ Themes List: September, 15
- ▶ Themes Candidates: September, 30
- ▶ Send email to bribeiro@dei.uc.pt with 3 preferences
- ▶ Themes assignment: October, 3
 - ▶ Will inform by email up to October, 5
- ▶ Seminars: since October, 13
- ▶ Comments: by email up to January 15

Seminars Calender (2)

- ▶ Overall monthly schedule:

October 13, 20, 27

November 3, 10, 17, 24

December 2, 9, 15

- ▶ Schedule: to be announced (t.b.a.)

Seminars Tentative Schedule (1)

Theme	Description	Week	Date	Bibliography	Student(s)
PP1	Feature Assessment & Model Graphical Inspection	6	t.b.a.	(MS, ch3); (Duda ch1)	t.b.a.
CL1	Hierarchical Clustering	6	t.b.a.	(MS, ch3)	t.b.a.
CL2	K-Means Clustering	7	t.b.a.	(MS, ch3);(Wu, ch2)	t.b.a.
TRP1	K-Nearest Neighbor	7	t.b.a.	(MS, ch4); (Wu, ch6)	t.b.a.
CE1	ROC Curves	8	t.b.a.	(MS, ch4);(Witten,ch5)	t.b.a.
CE2	Classifier Performance	8	t.b.a.	(MS, ch4)	t.b.a.
TRP2	Naive Bayes	8	t.b.a.	(MS, ch4);(Wu, ch9)	t.b.a.
TRP3	LD Classifiers	9	t.b.a.	(MS, ch4)	t.b.a.

Seminars Tentative Schedule (2)

Theme	Description	Week	Date	Bibliography	Student(s)
TRP3	LD Classifiers	9	t.b.a.	(MS, ch4)	t.b.a.
TRP4	Tree Classifiers	9	t.b.a.	(MS, ch5)	t.b.a.
TRP5	MLP classification	10	t.b.a.	(MS, ch5);(Pridy, ch2)	t.b.a.
TRP6	RBF prediction	10	t.b.a.	(MS, ch5);(Pridy, ch3)	t.b.a.
TRP7	SVM - hard margin Separable case	11	t.b.a.	(MS, ch5);(Wu, ch3)	t.b.a.
TRP8	SVM - soft margin NonSeparable Case	11	t.b.a.	(MS, ch5);(Wu,ch3)	t.b.a.
FS1	Feature Selection	15	t.b.a.	(MS, ch5)	t.b.a.

Seminars: Applications

- ▶ Person Identification
- ▶ Facial Expression Detection
- ▶ Vehicle Trajectory Recognition
- ▶ Object Recognition (ex: Car License Plate Recognition)
- ▶ Mouse Recognition
- ▶ Handwriting Character Recognition
- ▶ SPAM Detection
- ▶ Strategic Games
- ▶ Pattern Mining in the WEB (WWW, DataWarehouses, Business Intelligence, etc.)
- ▶ Link Analysis (PageRank)
- ▶ Stream Data Mining
- ▶ Speech Analysis