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270210 - PIE2 - Probability and Statistics 2

Coordinating unit: 270 - FIB - Barcelona School of Informatics

Teaching unit: 715 - EIO - Department of Statistics and Operations Research

Academic year: 2019

Degree: BACHELOR'S DEGREE IN DATA SCIENCE AND ENGINEERING (Syllabus 2017). (Teaching unit Compulsory)

ECTS credits: 6 Teaching languages: Catalan

Degree competences to which the subject contributes

Basic:

CB1. That students have demonstrated to possess and understand knowledge in an area of ??study that starts from the base of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that imply Knowledge from the vanguard of their field of study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of ??study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

CB5. That the students have developed those learning skills necessary to undertake later studies with a high degree of autonomy

Specific:

CE3. Analyze complex phenomena through probability and statistics, and propose models of these types in specific situations. Formulate and solve mathematical optimization problems.

Generical:

CG2. Choose and apply the most appropriate methods and techniques to a problem defined by data that represents a challenge for its volume, speed, variety or heterogeneity, including computer, mathematical, statistical and signal processing methods.

Transversal:

CT5. Solvent use of information resources. Manage the acquisition, structuring, analysis and visualization of data and information in the field of specialty and critically evaluate the results of such management.

CT6. Autonomous Learning. Detect deficiencies in one's own knowledge and overcome them through critical reflection and the choice of the best action to extend this knowledge.

Teaching methodology

Teaching methodology is described in Activities

Learning objectives of the subject

Study load

Total learning time: 150h	Theory classes:	30h	20.00%
	Laboratory classes:	30h	20.00%
	Guided activities:	0h	0.00%
	Self study:	90h	60.00%

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Content

(ENG) Introducció als processos estocàstics.

Degree competences to which the content contributes:

Description:
(ENG) Cadenes de Markov. Processos de Poisson.

Related activities:
(ENG)

Specific objectives:

(ENG) Model lineal

Degree competences to which the content contributes:

Description:
(ENG) Definició de model lineal normal. Estimació dels paràmetres Taula ANOVA i mesures de bondat d'ajust. Inferència sobre els paràmetres. Predicció. Validació del model. Selecció del model. Interpretació del model; Biaix, colinealitat i causalitat. Us de variables explicatives categòriques. Definició de model no-lineal normal; Ajust, inferència i validació.

Related activities:
(ENG)

Specific objectives:

(ENG) Model lineal generalitzat

Degree competences to which the content contributes:

Description:
(ENG) Definició de model lineal generalitzat. Model per a comptatges. Model per a resposta binària. Estimació dels paràmetres. Inferència sobre els paràmetres. Validació del model. Selecció del model. Predicció. Interpretació del model.

Related activities:
(ENG)

Specific objectives:

(ENG) Model additiu generalitzat

Degree competences to which the content contributes:

Description:
(ENG) Regressió polinòmica local. Validació creuada i compromís entre biaix i variança. Model additiu generalitzat.

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Related activities:
(ENG)

Specific objectives:

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Planning of activities

(ENG) Introducció als processos estocàstics	Hours: 32h Theory classes: 8h Practical classes: 0h Laboratory classes: 8h Guided activities: 0h Self study: 16h

Description:
(ENG) Entendre què son i perquè serveixen les cadenes de Markov i els processos de Poisson

Support materials:
(ENG)

Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG) 3, 4

(ENG) Models lineals	Hours: 40h Theory classes: 10h Practical classes: 0h Laboratory classes: 10h Guided activities: 0h Self study: 20h

Description:
(ENG) Definicio de model lineal normal. Estimacio. Inferència. Prediccio. Validació. Seleccio de model. Interpretació. Us de variables explicatives categòriques. Model no lineal normal.

Support materials:
(ENG)

Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG) 1, 5, 6, 7, 9, 10, 12, 13, 14

(ENG) Model lineal generalitzat	Hours: 24h Theory classes: 6h Practical classes: 0h Laboratory classes: 6h Guided activities: 0h Self study: 12h

Description:
(ENG) Definicio del model. Model per comptatges. Model per resposta binària. Estimació. Inferència. Validació. Predicció. Seleccio del Model. Interpretació. Taules de contingència i model per resposta politòmica.

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Support materials:
(ENG)

Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG) 1, 5, 6, 7, 9, 10, 11, 12, 13, 14

(ENG) Model additiu generalitzat	Hours: 8h Theory classes: 2h Practical classes: 0h Laboratory classes: 2h Guided activities: 0h Self study: 4h

Description:
(ENG) Model de regressió local. Model additiu. Validació creuada.

Support materials:
(ENG)

Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG)

(ENG) Estadística Bayesiana	Hours: 16h Theory classes: 4h Practical classes: 0h Laboratory classes: 4h Guided activities: 0h Self study: 8h

Description:
(ENG) Model estadístic. Inferència basada en versemblança. Model Bayesia. Distribució a posteriori. Distribucio predictiva a priori i a posteriori. Elecció de priori. Inferència Bayesiana. Validació del model. Computació Bayesiana.

Support materials:
(ENG)

Descriptions of the assignments due and their relation to the assessment:
(ENG)

Specific objectives:
(ENG) 2, 8

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Qualification system

There will be a partial exam and a final exam, as well as exercises of data analysis assigned during the course.

The partical exam will correspond to the Stochastic process part.

The final exam will correspond to the rest of the subject contents.

The course mark will be the sample mean of the exercices realized during the course.

The final mark will be computed as:

Subject Mark = 0.25 * Cours+ 0.25 * Partial+ 0.5 *FinalExam

In the case of the students that go to the reevaluation, the final mark will be computed like this:

Subject Mark=max(Reevaluation, 0,25Cours+0,75Reevaluation)

Bibliography

Basic:

James, G.; Witten, D.; Hastie, T.; Tibshirani, R. An introduction to statistical learning. Springer, 2013. ISBN 97-1461471370.

Gelman, A.; Carlin, J.B.; Stern, H.S.; Dunson, D.B.; Vehtari, A.; Rubin, D.. Bayesian data analysis [on line]. 3rd ed. Chapman & Hall, 2014Available on: <https://ebookcentral.proquest.com/lib/upcatalunya-ebooks/detail.action?docID=1438153>. ISBN 978-1439840955.

Weisberg, S. Applied linear regression [on line]. 4th ed. John Wiley and Sons, 2014Available on: <https://onlinelibrary.wiley.com/doi/book/10.1002/0471704091>. ISBN 9780471704096.

Dobson, A.J.; Barnett, A.G. An introduction to generalized linear models. 4th ed. Chapman & Hall, 2018. ISBN 978-1138741515.

Dobrow, R.P. Introduction to stochastic processes with R. John Wiley and Sons, 2016. ISBN 978-1118740651.