

## Estimation and Decision Techniques (E003421)

Course size (nominal values; actual values may depend on programme)

Credits 4.0 Study time 120 h Contact hrs 30.0 h

Course offerings and teaching methods in academic year 2020-2021

A (semester 1)	English	lecture	15.0 h
		seminar: coached	15.0 h
		exercises	
B (semester 1)	Dutch	guided self-study	15.0 h
		seminar: coached	15.0 h
		exercises	

Lecturers in academic year 2020-2021

Luong, Hiep	TW07	lecturer-in-charge
Noels, Nele	TW07	co-lecturer

Offered in the following programmes in 2020-2021

	crdts	offering
<a href="#">Brugprogramma Master of Science in Bioinformatics (main subject Engineering)</a>	4	A
<a href="#">Bridging Programme Master of Science in Industrial Engineering and Operations Research</a>	4	A
<a href="#">Bridging Programme Master of Science in Industrial Engineering and Operations Research</a>	4	A
<a href="#">Master of Science in Electrical Engineering (main subject Communication and Information Technology )</a>	4	A
<a href="#">Master of Science in Electrical Engineering (main subject Electronic Circuits and Systems)</a>	4	A
<a href="#">Master of Science in Bioinformatics (main subject Engineering)</a>	4	A
<a href="#">Master of Science in Industrial Engineering and Operations Research</a>	4	B
<a href="#">Master of Science in Computer Science Engineering</a>	4	A, B
<a href="#">Master of Science in Computer Science Engineering</a>	4	A
<a href="#">European Master of Science in Photonics</a>	4	A
<a href="#">Master of Science in Industrial Engineering and Operations Research</a>	4	A
<a href="#">Exchange Programme in Bioinformatics (master's level)</a>	4	A

Teaching languages

Dutch, English

Keywords

Estimation, Decision, Detection, Mean Square Error, Maximum Likelihood, Bayesian Inference

Position of the course

This introductory course aims at providing insight into a number of alternative methods that can be applied to estimate unknown quantities (estimation) or in testing hypotheses (decision).

These methods are applied in a.o. communications engineering, signal processing, and data processing.

Contents

- Introduction: problem formulation
- Classical estimation theory: Fisher estimation, minimum-variance unbiased

estimates, maximum-likelihood estimates, Pearson's method of moments, linear estimates, least-squares estimates

- Bayesian estimation theory: Bayesian estimates, linear Bayesian estimates
- Decision theory: classical decision, Bayesian decision
- Conclusions: overview

#### Initial competences

Know how to apply the basic rules of probability theory, possess knowledge about frequently used probability distributions

#### Final competences

- 1 Cast estimation or detection problems into a mathematical model.
- 2 Determine optimal receiver structures.
- 3 Determine (or approximate) the performance of receiver structures.
- 4 Develop an intuitive feeling for the resulting solution.
- 5 Weigh the pro's and con's of the different paradigms.

#### Conditions for credit contract

Access to this course unit via a credit contract is determined after successful competences assessment

#### Conditions for exam contract

This course unit cannot be taken via an exam contract

#### Teaching methods

Guided self-study, lecture, seminar: coached exercises

#### Learning materials and price

Syllabus (in English, available for download on the electronic learning environment or for sale at the price of the copies)

#### References

- S. Kay, "Fundamentals of Statistical Signal Processing, Volume 1: Estimation Theory" (Prentice Hall, 1993).
- S. Kay, "Fundamentals of Statistical Signal Processing, Volume 2: Detection Theory" (Prentice Hall, 1998).

#### Course content-related study coaching

Interactive support through the electronic learning environment and/or personal (by appointment)

#### Evaluation methods

end-of-term evaluation

#### Examination methods in case of periodic evaluation during the first examination period

Written examination, open book examination

#### Examination methods in case of periodic evaluation during the second examination period

Written examination, open book examination

#### Examination methods in case of permanent evaluation

#### Possibilities of retake in case of permanent evaluation

not applicable

#### Extra information on the examination methods

During examination period: written open-book exam - problems

#### Calculation of the examination mark