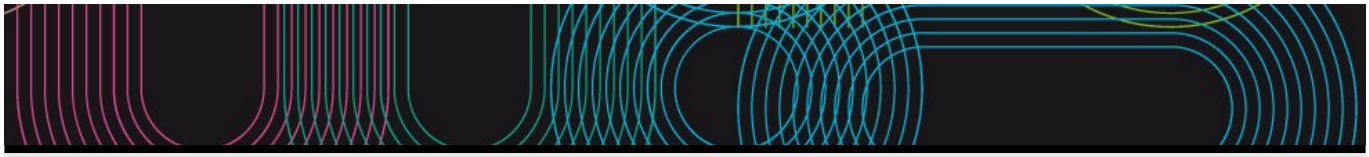

IDENTIFYING DATA				
(*)Procesado Estatístico de Sinal e Técnicas Bootstrap				
Subject	(*)Procesado Estatístico de Sinal e Técnicas Bootstrap			
Code	V05M038V01102			
Study programme	(*)Máster Universitario en Teoría do Sinal e Comunicacións.			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	5	Optional	1st	1st
Teaching language	Spanish			
Department				
Coordinator	Comesaña Alfaro, Pedro			
Lecturers	Comesaña Alfaro, Pedro Docampo Amoedo, Domingo			
E-mail	pcomesan@gts.tsc.uvigo.es			
Web	http://faitic.uvigo.es			
General description	(*)O curso está dirixido a estudantes que están interesados en realizar investigacións no ámbito de Teoría do Sinal e as súas Aplicacións. O curso pretende preparar estudantes que poidan seguir a literatura científica e que aspiren a contribuír con achegas orixinais á mesma. É por iso que se suscita a elaboración dun artigo científico propio seguindo as *pautas do *IEEE. Este artigo deberá empregar algún dos métodos presentados no curso para resolver un problema de interese para o estudante. Os artigos serán *evaluados mediante un proceso de *revisión por pares similar ao empregado por revistas do *IEEE. O curso divídese en catro *módulos: 1) introdución e fundamentos, 2) *modelado estatístico de sinais 3) estimación *espectral 4) técnicas *bootstrap.			

Competencies	
Code	
A1	(*)plantear simulaciones numéricas con variables aleatorias de diferente distribución y modelar diferentes procesos estocásticos
A2	(*)emplear acertadamente diferentes métodos de estimación paramétrica y no paramétrica del espectro de una señal y de funciones de densidad de probabilidad de una población
B1	(*)Que los estudiantes sepan aplicar los conocimientos adquiridos y su capacidad de resolución de problemas en entornos nuevos o poco conocidos dentro de contextos más amplios o multidisciplinares relacionados con el campo de estudio
B4	(*)Que los estudiantes sepan comunicar sus ideas, sus conclusiones ---y los conocimientos y razones últimas que las sustentan--- a públicos especializados y no especializados de un modo claro y sin ambigüedades, y que se formen específicamente para la enseñanza de los conceptos, los principios y las tecnologías que les son propios en los distintos niveles educativos
B5	(*)Que los estudiantes adquieran habilidades de aprendizaje que les permitan actualizar sus conocimientos de un modo autónomo, consciente y crítico
B6	(*)demostrar su capacidad de analizar y definir propuestas de sistemas, modelos, especificaciones y algoritmos
B7	(*)manejar de forma efectiva la búsqueda de artículos científicos y resumir de forma coherente y útil el nuevo conocimiento adquirido
B8	(*)transmitir el conocimiento adquirido redactando un informe con la extensión adecuada y al nivel exigido por el destinatario del mismo
B10	(*)analizar resultados experimentales, determinar su validez y emitir juicios razonados sobre su alcance
B11	(*)definir, realizar y ejecutar modelos de simulación en un lenguaje de programación de alto nivel como el Matlab o de bajo nivel como el C/C++
B13	(*)demostrar que puede trabajar en equipo de forma coordinada y complementaria y, concretamente en aprendizaje virtual, que utiliza provechosamente las herramientas de e-learning hacia estos objetivos

B14	(*)juzgar críticamente pero de forma positiva los razonamientos de sus compañeros en los foros de la herramienta e-learning y permitir que los demás juzguen los suyos, sacando así provecho de la puesta en común
B15	(*)desenvolverse en un contexto de trabajo internacional, sin prejuicios ni valoraciones infundadas sobre las capacidades de los demás compañeros
B18	(*)tener iniciativa y creatividad en la propuesta de soluciones sistémicas y algorítmicas alternativas a las estándar

Learning aims		
Expected results from this subject	Typology	Training and Learning Results
Determine the signal statistical model that better fits a given scenario	Know How	A1 B1 B4 B5 B6 B7 B8 B10 B11 B13 B14 B15 B18
Determine the most suitable spectral analysis technique for dealing with a given problem	Know How	A1 A2 B1 B4 B5 B6 B7 B8 B10 B11 B13 B14 B15 B18
Decide about the convenience of using bootstrap techniques for solving estimation problems.	Know How	A1 B1 B4 B5 B6 B7 B8 B10 B11 B13 B14 B15 B18

Contents	
Topic	
Introduction and Bases	Review of random signals and linear systems, introduction to the signal digital processing , formulation of the DFT, temporary and spectral sampling.
Statistical modelling of signals	Optimal linear filtering, introduction to adaptive filtering, linear prediction, Levinson-Durbin algorithm and lattice filtering, autorregresive modeling
Spectral analysis	Classical non-parametric analysis, parametric analysis (AR), other schemes of spectral analysis
Theoretic fundamentals of bootstrap technique	Computation of estimation error and confidence intervals of the estimate by using bootstrap. Applications

Planning			
	Class hours	Hours outside the classroom	Total hours
Master Session	25	25	50
Forum Index	10	10	20

Autonomous troubleshooting and / or exercises	5	35	40
Integrated methodologies	5	10	15

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Master Session	To take advantage of the course, the student should spend approximately 120 hours (10 hours per week for 12 weeks). Student with good bases on deterministic signal processing, linear algebra and statistics should be able to follow most of the content with a commitment of 120 hours. For each chapter several materials will be made available to the students, such as notes in PDF or examples of programs in MATLAB. This course deals with statistical signal processing techniques from the point of view of theory and practice. The main educational objectives are that students acquire competences related to: modeling real signals by using stochastic processes modeling techniques to model; perform spectral estimation using nonparametric methods and parametric methods based on signal modeling; perform time-frequency non-parametric and parametric estimates; apply bootstrap methodology applied to compute estimation errors, creating non-parametric confidence intervals and its application to solving problems in the field of signal theory. In addition to the knowledge and application of methods of statistical signal processing, students learn how to write scientific papers, practice the peer review process and will write a scientific paper, proving to have acquired the knowledge and skills specified.
Forum Index	Students' participation in the forums on the website of the course will be assessed.
Autonomous troubleshooting and / or exercises	In order to check the understanding by students of the contents, the student must solve by himself/herself a series of problems; the resolution of these exercises will make a 70% of the final mark.
Integrated methodologies	Students will prepare a final project in which they must demonstrate their mastery in the contents of the subject. This final project will follow the format of a scientific paper in any of the conferences of reference in the field. This article shall employ any of the methods presented in the course to solve a problem of interest to the student. Items will be evaluated by a peer review process similar to that used by IEEE journals.

Personalized attention

Methodologies	Description
Master Session	Due to the non presencial nature of this master, the main tools for the personalized attention will be the e-mail and the phone calls. For those students who can attend to the E.E. Telecomunicación, there will be also the possible of attending to office hours.
Forum Index	Due to the non presencial nature of this master, the main tools for the personalized attention will be the e-mail and the phone calls. For those students who can attend to the E.E. Telecomunicación, there will be also the possible of attending to office hours.
Autonomous troubleshooting and / or exercises	Due to the non presencial nature of this master, the main tools for the personalized attention will be the e-mail and the phone calls. For those students who can attend to the E.E. Telecomunicación, there will be also the possible of attending to office hours.

Assessment

	Description	Qualification
Forum Index	El curso requiere un total de 5 tareas: realización de 4 trabajos cortos con sus respectivas aportaciones al foro (70% de la nota final) y un Proyecto Final (30% de la nota final). Tanto el informe como la correspondiente aportación al foro deberán ser entregados el lunes de la semana correspondiente (2 semanas por tarea).	10
Autonomous troubleshooting and / or exercises	For each chapter the students must prepare a report with the solutions to the proposed practical exercises.	60
Integrated methodologies	An important requirement of the course is the development of a scientific paper following the guidelines of the IEEE. This article will use some of the methods presented in the course to solve a problem of interest to the student. Items will be evaluated by a peer review process similar to that used by IEEE journals. The article should be comparable to the articles currently published in the IEEE conferences such as ICASSP, EMBC, etc..	30

Other comments on the Evaluation

This course requires the development of 5 tasks: 4 short tasks with the related contributions to the forum (70% of the final

mark) and a final project (30% of the final mark). Both the task reports and the related forum contribution should be sent by the Monday of the corresponding week (2 weeks per task).

Sources of information

John G. Proakis, Dimitris G. Manolakis, **Tratamiento Digital de Señales**, Prentice Hall,
Artículos científicos accesibles desde la bibloteca de la UVigo,

The materials required to follow the course can be found in this textbook.

Besides this text, notes and papers for each chapter will be provided.

Recommendations

Subjects that are recommended to be taken simultaneously

(*)Métodos de Simulación de Sinais Aleatorios/V05M038V01101
(*)Recoñecemento Estatístico de Patróns e Redes Neuronais/V05M038V01103

Other comments

The course is aimed at students who are interested in conducting research in the field of Signal Theory and Applications. The course aims to prepare students who can follow the scientific literature and who aspire to contribute original contributions to it. That is why we consider the development of a scientific paper itself along the lines of the IEEE. This article shall employ any of the methods presented in the course to solve a problem of interest to the student. Papers will be evaluated by a peer review process similar to that used by IEEE journals.