UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Matematica e Informatica
ACADEMIC YEAR	2020/2021
MASTER'S DEGREE (MSC)	MATHEMATICS
SUBJECT	THEORIES AND TECHNIQUES OF IMAGE ANALYSIS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20947-Attività formative affini o integrative
CODE	16522
SCIENTIFIC SECTOR(S)	INF/01
HEAD PROFESSOR(S)	TEGOLO DOMENICO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	94
COURSE ACTIVITY (Hrs)	56
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**TEGOLO DOMENICO** Wednesday 15:00 17:00 Dipartimento Matematica e InformaticaVia Archirafi 3490123Palermo

DOCENTE: Prof. DOMENICO TEGOLO

PREREQUISITES	no additional competence is required.
LEARNING OUTCOMES	Knowledge and understanding Acquisition and use of advanced methods for the analysis of Biomedical images, in particular, the fundamental concepts for the automatic search for specific patterns present in medical images and for their classification. Ability to apply knowledge and understanding Ability to apply this knowledge to real data, identification of algorithms for specific problems in biomedical image analysis. Ability to recognize, and organize independently, the elements necessary for the deepening of a research article in the field of Biomedical data analysis. Ability to formalize problems and elaborate techniques drawn from scientific articles of contemporary literature. Autonomy of judgment Be able to evaluate the goodness of methods and the contents of a scientific article. Broad understanding of the advanced concepts related to the extraction of characteristics from image data, to their transformation for correct classification. Be able to evaluate the implications and results contained in a recent research article. The achievement of this autonomy will be verified through the exhibition of the seminars and the final exam. Communication skills Properties of expression in the presentation of methodologies related to the fields of application of biomedical data analysis. Ability to articulate the main topics of the course. Ability to present the methods, results and validations contained in a research article with clarity and rigour. Verification of communicative abilities will take place through the involvement of students in seminar activities.
ASSESSMENT METHODS	The final exam will focus on the analysis of the seminars carried out, on the discussion of a topic in oral form and on questions concerning the basic knowledge of the course. The final exam has the purpose of evaluating, beyond the basic knowledge and possession of language properties, also the mathematical rigour and the applicative capacity of the candidate. The final evaluation will be based on the following conditions: a) Basic knowledge of the proposed topics and limited ability to apply them independently; sufficient ability to complete a rigorous reasoning and sufficient language ownership (grade 18-21); b) Discrete knowledge of the proposed topics and sufficient ability to apply them independently; good ability to complete a rigorous reasoning and good language properties (grade 22-25); c) Good knowledge of the proposed topics and ability to apply them with mathematical rigour, but not in full autonomy; possession of good language properties (grade 26-28); d) Very good, wide and high knowledge of the proposed topics; ability to apply them with rigour and in full autonomy; possession of excellent communication skills (grade 29-30L).
EDUCATIONAL OBJECTIVES	The course aims to provide students with theoretical and application concepts for the definition and implementation of methods and algorithms for the automatic analysis of biomedical images. Development of the ability to apply them in the field of work.
TEACHING METHODS	The achievement of the teaching objectives will be achieved through frontal lessons and laboratory experiences, scientific contributions will be distributed in order to deepen, with independent study, the topics proposed during the frontal lessons. Additionally, students will have short seminars based on distributed articles about further course topics or complementary themes. The final exam consists of an oral examination in order to ascertain the acquired skills.
SUGGESTED BIBLIOGRAPHY	- R. M Rangayyan, Biomedical Image Analysis, CRC Press. - A.Meyer-Baese - Pattern Recognition in Medical Imaging, Elsevier.

SYLLABUS

Hrs	Frontal teaching
2	The nature of biomedical images
2	Artifact removal.
6	Image Enhancement, Digital operations, image transformation, convolution filter, contrast enhancement.
6	Region of interest, region growing, threshold, corner.
6	Shape analysis: representation of shapes and contours, shapes representation codes, polynomial modelling for contour modelling, skeleton, characterization of shapes through essential parameters, Fourier descriptors.
2	Texture Analysis: Texture Generation Templates, Texture Analysis, Structural Segmentation and Structural Analysis.
6	Reconstruction of images by projections: geometric projections, Fourier slice theorem, algebraic reconstruction techniques, approximation with the Kaczmarz method.
2	Image Processing, Clustered Image Segmentation, Multispectral Image Segmentation, Image Registration

Hrs	Practice
2	Practical exercises on domain space
2	Some experience on contrast enhancement.
2	Exercises on binary image and threshold
2	Some experience on segmentation.
3	Exercises on Corner and spots.
4	Experience of laboratory on application in: frequency space, filters on image data.
4	Methods and algorithms for clustering.
2	Some exercises on algorithms for hierarchical clusters, partitioning clustering.
3	Some experience on algorithms for 3D image reconstruction