Study Regulations Governing the Master's Degree Programme in Visual Computing

30 April 2020

Note: This translation is provided for information purposes only. In the event of any discrepancy between the translation and the original German version published in the Official Bulletin (*Dienstblatt der Hochschulen des Saarlandes*), the provisions of the latter shall take precedence.

Pursuant to Section 60 of the Saarland Higher Education Institutions Act (SHSG) (Official Gazette of Saarland I, p. 1080) most recently amended in law by the Act of 10 April 2019 (Official Gazette I, p. 412) and pursuant to the Joint Examination Regulations for Bachelor's and Master's Degree Programmes of Faculty 6 (Natural Science and Technology Faculty I – Mathematics and Computer Science) of 2 July 2015 (Official Bulletin, p. 616) as amended by the Ordinance to Amend the Joint Examination Regulations for Bachelor's and Master's Degree Programmes of Faculty 6 (Natural Science and Technology Faculty I – Mathematics and Computer Science) of 28 April 2016 (Official Bulletin, p. 404) and with the consent of the Saarland University Senate, the Faculty of Mathematics and Computer Science at Saarland University hereby issues the following Study Regulations Governing the Master's Degree Programme in Visual Computing.

Section 1
Scope

These study regulations, which govern the content and structure of the Master's degree programme in Visual Computing, are based on the Joint Examination Regulations for the Bachelor's and Master's Degree Programmes of Faculty 6 (Natural Science and Technology Faculty I – Mathematics and Computer Science) of 2 July 2015 (Official Bulletin, p. 616) as amended by the Ordinance to Amend the Joint Examination Regulations for Bachelor's and Master's Degree Programmes of Faculty 6 (Natural Science and Technology Faculty I – Mathematics and Computer Science) of 26 September 2016 (Official Bulletin, p. 404) and on the Subject-Specific Regulations for the Master's Degree Programme in Visual Computing of 30 April 2020. The Faculty of Mathematics and Computer Science is responsible for organizing the teaching, study curriculum and examinations associated with this programme.

Section 2
Objectives of the degree programme and career relevance

As visual impressions are the most important form of human sensory perception, there is an increasing trend in computer-assisted information processing to replace text-based content with visual representations. The computer-aided processing of visual information is of central significance in telecommunications, the multimedia sector, industrial quality control, medical technology, driver assistance systems, pattern recognition problems in bioinformatics, scientific computation, augmented reality applications, data science, artificial intelligence, media design and in robotics.

The goal of the Master's degree programme in Visual Computing is to teach students the fundamental principles, processes and applications of computer-assisted processing of visual information. The Master's programme, which is based at the Department of Computer

Science, maintains interdisciplinary links to numerous other disciplines, particularly mathematics, physics and electrical engineering but also to medical engineering, biology, computer linguistics and the cognitive sciences.

Section 3
Start and duration of programme

(1) Students can begin the programme at the beginning of the winter or summer semester of each year.

(2) The curriculum is organized such that the programme can be completed in four semesters (standard period of study).

Section 4
Teaching and learning formats

The curriculum content is taught using the following types of academic instruction:

1. Lectures (‘L’, standard class size = 100): Lectures serve to introduce a particular subject area and also provide an overview of the relevant theoretical concepts and principles, methodologies and skills, technologies and practical implementations that are common to the subject. Lecture courses provide suggestions for further reading on a topic and open the way to acquiring a deeper understanding of an area through subsequent exercise and problem-solving classes, practical skills classes and self-directed study.

2. Exercise and problem-solving classes (‘EP’, standard class size = 20): Exercise and problem-solving classes are small-group sessions used primarily to supplement and reinforce what was learned in the lectures. Students work on representative problems as this provides an opportunity for them to apply and deepen the knowledge they acquired in the lectures, to assess their personal understanding of a specific area and to clarify any questions that they may have.

3. Seminars (‘S’, standard class size = 15): Seminars provide an opportunity for students to broaden the knowledge and skills that they have already acquired and to gain a deeper understanding of a particular field of research by participating in discussions, giving presentations or completing seminar papers, based on their study of the specialist literature and relevant academic sources. They also help students acquire the skills necessary for the effective oral and visual presentation of scientific and academic content and encourage students to engage in critical analysis and discussion of research results. A seminar may also include project-related work in areas of current scientific interest or debate. The deeper understanding of a particular field that students acquire through project-related work in the Master’s seminar may provide the basis for their final-year Master’s thesis.

4. Practical skills classes and project work (‘P’, standard class size = 15; Master’s thesis project, standard class size = 6): Practical skills classes or projects offer a number of practical, subject-related topics that introduce students to the specific approaches and methods used in a particular discipline or field of study. The necessary theoretical knowledge underlying a specific topic is acquired by attending lectures and studying the relevant scientific literature. An additional goal of the practical skills classes is to provide students with the opportunity to gain practical experience with computer-aided methods. Projects tend to address interdisciplinary topics. Working on a topic offers students the opportunity to work in supervised groups to tackle specific assignments from the initial solution design concept through to its final practical implementation.

Students learn about the relationships between theory and practice not only through their own independent study and research, but also through project-based teamwork. Participation in a particular practical skills class or project may be dependent on a student having first successfully completed a required course of lectures and the associated exercise and problem-solving classes.

Section 5
The structure and content of the programme

(1) To graduate from the Master's programme Visual Computing, students shall earn a total of 120 credits as defined by the European Credit Transfer System (ECTS). As a rule, students are required to earn 30 credits per semester.

(2) The degree programme comprises modules from different module categories. Appendix A provides details of the modules and module elements in each of these categories, the type of academic instruction used, the associated workload (number of credit hours per week), the ECTS credits earned, the type of academic assessment and whether the module is graded. Students are required to earn the specified number of credits in each of the module categories. To graduate from the programme, students must complete the requirements for each 'mandatory elective module category' (*Wahlpflichtbereich* – hereafter: 'module category') and complete the requirements for the Master's thesis and Master's seminar. In each module category, students can select modules/module elements from a specified list.

1. At least 39 graded credits from lecture courses in the core discipline of visual computing. The minimum number of credits that have to be earned in each of the module categories a) to c) are as follows:

a) at least 3 graded credits from lecture courses in the module category 'Image Acquisition':
   - Image Acquisition Methods (6 credits)
   - Ultrasound Imaging (3 credits)
   - Physical Acoustics 1 (3 credits)
   - Physical Acoustics 2 (4 credits)

b) at least 9 graded credits from lecture courses in the module category 'Image Analysis':
   - Image Processing and Computer Vision (9 credits)
   - Differential Equations in Image Processing and Computer Vision (9 credits)
   - Image Compression (9 credits)
   - Differential Geometric Aspects of Image Processing (6 credits)
   - Probabilistic Methods in Image Analysis (6 credits)
   - Advanced Image Analysis (6 credits)
   - Correspondence Problems in Computer Vision (6 credits)
   - Probabilistic Graphical Models and their Applications (6 credits)
   - High Level Computer Vision (6 credits)

c) at least 9 graded credits from lecture courses in the module category 'Image Synthesis':
   - Computer Graphics (9 credits)
   - Realistic Image Synthesis (9 credits)
   - Geometric Modelling (9 credits)
   - Perception for Computer Graphics (3 credits)

- Computation and Fabrication (6 credits)

2. at least 9 graded credits from lecture courses in the module category ‘Image-Related Fields’:
    - Elements of Data Science and Artificial Intelligence (6 credits)
    - Elements of Machine Learning (6 credits)
    - Machine Learning (9 credits)
    - Neural Networks: Theory and Implementation (9 credits)
    - Statistical Natural Language Processing (6 credits)
    - Artificial Intelligence (9 credits)
    - AI Planning (9 credits)
    - Information Retrieval and Data Mining (9 credits)
    - Topics in Algorithmic Data Analysis (6 credits)
    - Digital Transmission and Signal Processing (9 credits)
    - Audio/Visual Communication & Networks (9 credits)
    - Multimedia Transport (9 credits)
    - Human-Computer Interaction (9 credits)
    - Non-Destructive Testing I (4 credits)
    - Other lecture courses, such as modules/module elements from the advanced modules category associated with the lecture courses listed above, lectures on speech recognition and computer linguistics, lectures on medical engineering, and, when offered, lectures on robotics and on instrumentation and measurement technology

3. 7 graded credits from the module category ‘Seminars on topics in the core discipline of visual computing or in image-related fields’ (see Sec. 5(2), items 1 and 2 above)

4. At least 18 credits from the module category ‘Supplementary modules covering fundamental areas in other approved disciplines’ (of which 9 credits must be from graded assessments or assignments): The approved lecture courses will be announced at the beginning of the semester. The lecture courses that a student takes shall be predominantly in areas that were not part of the student’s earlier Bachelor’s degree programme and should serve to fill in any gaps in the student’s prior learning. Lecture courses can be selected from the following (non-exhaustive) list:
    - Mathematics (e.g. Numerical Algorithms for Visual Computing, Interpolation and Approximation for Visual Computing, Convex Analysis and Optimization, Numerical Methods for ODEs, Stochastics I+II, Partial Differential Equations I+II, Modelling with Partial Differential Equations, Introduction to Numerical Methods, Numerical Internship in Computerized Tomography, Functional Analysis I)
    - Computer science (e.g. Programming 1, Programming 2, Software Lab Course, Systems Architecture, Software Engineering, Algorithms and Data Structures, Optimization, Space Informatics)
    - Mechatronics (e.g. Fundamentals of Signal Processing, Digital Signal Processing, Multi-Sensor Signal Processing)
    - Physics (e.g. Introduction to Physics I and II, Physics for Engineers I and II)

5. At least 10 ungraded credits from the module category ‘Freely selectable modules’, which can be chosen from the following options:
    - Freely selectable modules from the field of Visual Computing
    - Tutoring and supervising undergraduate students in exercise and problem-solving classes (usually 4 credits); tutoring several groups of students is

permitted, provided that the exercise and problem-solving classes are from different modules.

- Language courses (maximum of 6 credits; modern languages only and not the student's native language)
- Master's level practical assignment / project or research immersion labs (each worth 6 credits)
- Work placement or internship in industry (maximum of 6 credits) for which an application was submitted to and approved by the Examination Board
- Modules or module elements for which an application was submitted to and approved by the Examination Board, e.g. from disciplines such as psychology, media design or the cognitive sciences. Students may, for example, submit an application to the Examination Board requesting recognition of certain student activities (particularly university-related administrative activities) or of attendance at courses teaching key skills (maximum of 3 credits in each case).

6. 7 graded credits from the Master's seminar on a topic from the core discipline of visual computing and

   30 graded credits for the Master's thesis on a topic from the core discipline of visual computing.

(3) Of the 120 credits that have to be earned in the Master's degree programme in Visual Computing, at least 101 credits shall be from graded assessments or assignments.

(4) To fulfil the mandatory curricular requirements, students shall complete all of the modules specified in Section 5(2), item 6 above (total number of credits earned: 37). In each of the mandatory module categories, students can take modules or module elements from a specified list provided that they meet the relevant prerequisites for the particular module or module element selected. (Students must earn 83 credits in total from these modules or module elements). Credits from academic assessments and examinations that were used to obtain a Bachelor's degree cannot also be used to meet the degree requirements of the Master's programme. However, any credits from academic assessments and examinations that were earned during the Bachelor's degree period but that were not used to meet the total credit requirements for the Bachelor's programme may be transferred to the Master's programme provided that they do not exceed 30 credits in total.

(5) The number of places available in practical skills classes, seminars, tutoring activities, language courses are limited. In certain exceptional cases and where reasonable grounds exist, limits may be placed on the number of places available on modules in other sections of the programme curriculum. Admission to these modules is managed by the module coordinator.

(6) Academic credits are either graded or ungraded. A graded academic assessment or examination cannot be split into ungraded and graded credits.

(7) A student who has received academic credits for successfully completing the assessment or examination associated with a lecture course is permitted to retake the assessment or examination on one further occasion within the same examination period in order to improve the grade awarded, provided that the lecturer gave notice at the beginning of the course that the final examination or assessment may be repeated for this purpose. The student will be awarded the better of the two grades achieved. In all other cases, students are not permitted

to repeat an assessment or examination for which they have already achieved at least the minimum passing grade.

(8) The Dean of Studies shall ensure that the number of lecture courses and seminars offered each academic year meets at least the minimum requirements of the programme curriculum.

(9) The language of instruction will be announced at the beginning of the module or module element. It shall be ensured that the Master's degree programme in Visual Computing can be studied completely in English.

(10) The range of modules offered in the mandatory module categories may be modified for one or more semesters, though such a change shall require the approval of the Examination Board. These additional modules or module elements, their weighting in ECTS credits and the module category to which they belong will be announced before the semester begins.

(11) Detailed information regarding the content of modules and module elements is provided in the module catalogue that will be made available in suitable form. Any changes or amendments to the information in the module catalogue that are not covered by the provisions of these regulations shall be reported to the Dean of Studies and documented appropriately.

(12) Course attendance may be compulsory for certain seminars, exercise or problem-solving classes and practical skills classes. Students will be notified of this by the instructor at the beginning of the module or module element. The mandatory attendance requirement is normally deemed to have been met if a student was present for at least 85% of the course sessions. If there are reasonable grounds for a student's absence, the student may be offered the option of completing an alternative assignment.

Section 6
Study plan

The Dean of Studies shall compile a study plan based on these study regulations that includes details of the types and scope of the modules / module elements offered (Appendix A) with recommendations on how students can organize and structure their studies efficiently (Appendix B). The study plan will be made available in suitable form. The range of modules / module elements offered in a particular semester will be published in the Saarland University course catalogue for that semester.

Section 7
Student advisory services

(1) The Central Student Advisory Service (*Zentrale Studienberatung*) at Saarland University provides counselling and guidance to prospective students and enrolled students concerning the content, structure and requirements of academic study at Saarland University. It can also assist students when deciding between various study options and can provide advice on general questions regarding study planning and organization.

(2) Questions concerning curricular demands, learning objectives, admission requirements and study planning and organization can be addressed to the programme adviser for the Master's programme in Visual Computing.

(3) Questions specific to individual modules should be addressed to the respective module coordinators.

Section 8
Studying or interning abroad

Students have the opportunity to spend part of the programme studying abroad or conducting a work placement / internship in another country. Students interested in either of these options should attend a consultation session, take preparatory language courses if required, and should clarify credit transfer arrangements in accordance with the relevant examination regulations by completing a study abroad learning agreement. Information on opportunities to study or complete practical training abroad, as well as information on exchange programmes, scholarships and administrative formalities is available from the Saarland University International Office or from the relevant departmental or subject representatives. As foreign host universities and scholarship-awarding bodies often have early application deadlines and long application processing times, study abroad applications should normally be submitted to the Examinations Office one year before the planned start date.

Section 9
Master's thesis and Master's seminar

(1) By completing a Master's thesis, students demonstrate that they are able to work independently on tackling problems in the core discipline of visual computing. The completion period for the Master's thesis is six months. Students are awarded 30 ECTS credits for completing their Master's thesis.

(2) Before finishing their Master's thesis, each student shall have successfully completed a Master's seminar in an area with direct relevance to the topic being addressed in the thesis. Students attending a Master's seminar shall give an oral presentation on the problem they propose to tackle in their Master's thesis.

(3) Students shall register their thesis project with the Examinations Office no later than one semester after successfully completing the Master's seminar. Students who fail to meet this deadline will be required to successfully complete another Master's seminar.

Section10
Commencement

(1) This regulation shall come into force on the day after it is announced in the Official Bulletin of the Institutions of Higher Education in Saarland (*Dienstblatt der Hochschulen des Saarlandes*).

(2) Students who began studying for their Master's degree in Visual Computing at the Faculty of Mathematics and Computer Science before these regulations entered into force shall continue to study under the regulations applicable at the time they began the programme, but shall complete their studies including the final academic assessment and examination phase by the end of winter semester 2022/2023.

Saarbrücken, 9 April 2021

President of Saarland University
(Univ.-Prof. Dr. Manfred Schmitt)

Appendix A – Modules, assessments and examinations in the Master's degree programme 'Visual Computing'

Master's degree programme (M.Sc.) Visual Computing

						Winter semester		**Summer semester**		**Winter semester**		**Summer semester**	
Module category	**Modules**	**Type of assessment**	Graded/ Ungraded	**ECTS credits**		**Subject semester**							
						1		**2**		**3**		**4**	
				Un-graded	graded	L/EP/P hrs/wk	credits	L/EP/P hrs/wk	credits	L/EP/P hrs/wk	credits	L/EP/P hrs/wk	credits
Core discipline 'Visual Computing', comprising:			g	0	at least 39								
a) Mandatory elective modules in 'Image Acquisition'	(variable credits, see list below)	written exam(s), PA	g	0	at least 3	2/0/0	3	2/2/0	6				
b) Mandatory elective modules in 'Image Analysis'	(variable credits, see list below)	written exam(s), PA	g	0	at least 9	4/2/0	9	2/2/0	6				
c) Mandatory elective modules in 'Image Synthesis'	(variable credits, see list below)	written exam(s), PA	g	0	at least 9	4/2/0	9	2/2/0	6				
Mandatory elective modules in 'Image-Related Fields'	(variable credits, see list below)	written exam(s), PA	g	0	at least 9					4/2/0	9		
Mandatory elective seminars in the core discipline 'Visual Computing'*		oral, written	g	0	7					0/0/3	7		
Mandatory elective supplementary modules covering fundamental areas in other approved disciplines*	(variable credits)		u/g	9	at least 9	4/2/0	9	4/2/0	9				
Freely selectable mandatory elective modules	(modules offered subject to change, variable credits, see list below)		u	at least 10	0				4		6		
	Master's seminar	oral, written	g	0	7						7		
	Master's thesis	Master's thesis	g	0	30								30
TOTAL				**at least 19**	**at least 101**		**30**		**31**		**29**		**30**

* The range of modules offered in these module categories varies from semester to semester and is published in the course catalogue. The Examination Board may add modules to or withdraw modules from this list.

Mandatory elective modules in 'Image Acquisition'

(The Examination Board may add modules to or withdraw modules from this list.)

Modules	Type of assessment	Graded/Ungraded	ECTS credits	
			ungraded	graded
Image Acquisition Methods	written exam(s), PA	g	0	6
Ultrasound Imaging	written exam(s), PA	g	0	4
Physical Acoustics 1	written exam(s), PA	g	0	3
Physical Acoustics 2	written exam(s), PA	g	0	4

Mandatory elective modules in 'Image Analysis'

(The Examination Board may add modules to or withdraw modules from this list.)

Modules	Type of assessment	Graded/ Ungraded	ECTS credits	
			Un-graded	graded
Image Processing and Computer Vision	written exam(s), PA	g	0	9
Differential Equations in Image Processing and Computer Vision	written exam(s), PA	g	0	9
Image Compression	written exam(s), PA	g	0	9
Differential Geometric Aspects of Image Processing	written exam(s), PA	g	0	6
Probabilistic Methods in Image Analysis	written exam(s), PA	g	0	6
Advanced Image Analysis	written exam(s), PA	g	0	6
Correspondence Problems in Computer Vision	written exam(s), PA	g	0	6
Probabilistic Graphical Models and their Applications	written exam(s), PA	g	0	6
High Level Computer Vision	written exam(s), PA	g	0	6

Mandatory elective modules in 'Image Synthesis'

(The Examination Board may add modules to or withdraw modules from this list.)

Modules	Type of assessment	Graded/Ungraded	ECTS credits	
			ungraded	graded
Computer Graphics	written exam(s), PA	g	0	9
Realistic Image Synthesis	written exam(s), PA	g	0	9
Geometric Modeling	written exam(s), PA	g	0	9
Perception for Computer Graphics	written exam(s), PA	g	0	3
Computation and Fabrication	written exam(s), PA	g	0	6

Mandatory elective modules in 'Image-Related Fields'

(The Examination Board may add modules to or withdraw modules from this list.)

Modules	Type of assessment	Graded/ Ungraded	ECTS credits	
			Un-graded	graded
Elements of Data Science and Artificial Intelligence	written exam(s), PA	g	0	6
Elements of Machine Learning	written exam(s), PA	g	0	6
Machine Learning	written exam(s), PA	g	0	9
Neural Networks: Theory and Implementation	written exam(s), PA	g	0	9
Statistical Natural Language Processing	written exam(s), PA	g	0	6
Artificial Intelligence	written exam(s), PA	g	0	9
AI Planning	written exam(s), PA	g	0	9
Information Retrieval and Data Mining	written exam(s), PA	g	0	9
Topics in Algorithmic Data Analysis	written exam(s), PA	g	0	6
Digital Transmission and Signal Processing	written exam(s), PA	g	0	9
Audio/Visual Communication & Networks	written exam(s), PA	g	0	9
Multimedia Transport	written exam(s), PA	g	0	9
Human-Computer Interaction	written exam(s), PA	g	0	9
Non-Destructive Testing I	written exam(s), PA	g	0	3
Advanced lecture courses associated with the lectures listed above Lectures on speech recognition and computer linguistics Lectures on medical engineering Lectures on robotics and instrumentation and measurement technology (if offered)				

Mandatory elective module category 'Freely selectable modules'

(The Examination Board may add modules to or withdraw modules from this list.)

Modules	Type of assessment	Graded/ Ungraded	ECTS credits	
			ungraded	graded
Modules from the field of visual computing				
Master's level practical assignment / project or research immersion labs	Practical assignment / project	u	6	0
Tutoring	Tutoring	u	4	0
Language courses (max. 6 credits)	oral written	u	3 or 6	0
Industrial work placement / internship (max. 6 credits)		u	6	0

* The range of modules offered in these module categories varies from semester to semester and is published in the course catalogue. The Examination Board may add modules to or withdraw modules from this list.

Key:

L = Lecture

EP = Exercise and problem-solving class

P = Project or practical training

PA = Preliminary assessment

credits = ECTS credits

credit hrs/wk = no. of class or supervised hours per week during the semester

Appendix B – Sample study plan Master's Degree Programme in Visual Computing

↵ Semester				Credits →
1	Mandatory elective 'Image Acquisition' (3 credits)	Mandatory elective 'Image Analysis' (9 credits)	Mandatory elective 'Image Synthesis' (9 credits)	Mandatory elective module category 'Supplementary modules covering fundamental areas in other approved disciplines' (9 credits)	30
2	Mandatory electives from 'Image Acquisition', 'Image Analysis' or 'Image Synthesis'" (total: 18 credits)		Mandatory elective module category 'Freely selectable modules' (e.g. Tutoring; 4 credits)	Mandatory elective module category 'Supplementary modules covering fundamental areas in other approved disciplines' (9 credits)	31
3	Mandatory elective module category 'Image-Related Fields' (9 credits)	Seminar (7 credits)	Mandatory elective module category 'Freely selectable modules' (e.g. language course; 6 credits)	Master's seminar (7 credits)	29
4	Master's thesis (30 credits)				30