

Program of Studies:	Master Program Bioinformatics
Name of the module:	Image Processing and Computer Vision
Abbreviation:	I-M-9
Subtitle:	Core Lecture
Modules:	Lecture: 4 h (weekly) Tutorial: 2 h (weekly)
Semester:	1 st -3 rd semester/at least every two years
Responsible lecturer:	Prof. Dr. Joachim Weickert
Lecturer:	Prof. Dr. Joachim Weickert
Language:	English
Level of the unit/ Mandatory or not:	Graduate course / mandatory elective
Total workload:	270 h = 90 h of classes and 180 h private study;
Credits:	9
Entrance requirements:	Undergraduate mathematics (e.g. Mathematik für Informatiker I-III) and elementary programming knowledge in C
Aims/Competences to be developed:	Broad introduction to mathematical methods in image processing and computer vision. The lecture qualifies students for a bachelor thesis in this field. Together with the completion of advanced or specialised lectures (9 credits at least) it is the basis for a master thesis in this field.
Content:	<ol style="list-style-type: none"> 1. Basics <ol style="list-style-type: none"> 1.1 Image Types and Discretisation 1.2 Degradations in Digital Images 2. Colour Perception and Colour Spaces 3. Image Transformations <ol style="list-style-type: none"> 3.1 Continuous Fourier Transform 3.2 Discrete Fourier Transform 3.3 Image Pyramids 3.4 Wavelet Transform 4. Image Compression 5. Image Interpolation 6. Image Enhancement <ol style="list-style-type: none"> 6.1 Point Operations 6.2 Linear Filtering and Feature Detection 6.3 Morphology and Median Filters 6.3 Wavelet Shrinkage, Bilateral Filters, NL Means 6.5 Diffusion Filtering 6.6 Variational Methods 6.7 Deconvolution Methods

	<ul style="list-style-type: none"> 7. Texture Analysis 8. Segmentation <ul style="list-style-type: none"> 8.1 Classical Methods 8.2 Variational Methods 9. Image Sequence Analysis <ul style="list-style-type: none"> 9.1 Local Methods 9.2 Variational Methods 10. 3-D Reconstruction <ul style="list-style-type: none"> 10.1 Camera Geometry 10.2 Stereo 10.3 Shape-from-Shading 11. Object Recognition <ul style="list-style-type: none"> 11.1 Hough Transform 11.2 Invariants 11.3 Eigenspace Methods
Assessment/Exams:	<ul style="list-style-type: none"> - For the homework assignments one can obtain up to 24 points per week. Actively participating in the classroom assignments gives 12 more points per week, regardless of the correctness of the solutions. To qualify for both exams one needs 2/3 of all possible points. - Passing the final exam or the re-exam. - A re-exam takes place during the last two weeks before the start of lectures in the following semester.
Grade:	Will be determined from the performance in the exam or the re-exam. The better grade counts.
Literature:	Will be announced before the start of the course on the course page on the Internet.