	INSTITUT TEKNOLOGI SEPULUH NOPEMBER (ITS) **FACULTY OF SCIENCE AND DATA ANALYTICS** **DEPARTMENT OF MATHEMATICS**	**Kode Dokumen**

RENCANA PEMBELAJARAN SEMESTER/ SEMESTER LEARNING PLAN

MATA KULIAH (MK) ***COURSE***	**KODE** ***CODE***	**Rumpun MK** ***Course Cluster***	**BOBOT (sks)** ***Credits***		**SEMESTER** ***Semester***	**Tgl Penyusunan** ***Compilation Date***
Analisis dan Pengolahan Citra *Image Processing and Analysis*	KM186220	Ilmu Komputer *Computer Science*	3		2	
OTORISASI / PENGESAHAN ***AUTHORIZATION / ENDORSEMENT***	**Dosen Pengembang RPS** ***Developer Lecturer of Semester Learning Plan***		**Koordinator RMK** ***Course Cluster Coordinator***		**Ka DEPARTEMEN** ***Head of Department***	
			(Jika ada) Tanda tangan		Tanda tangan	

Capaian Pembelajaran ***Learning Outcomes***	**CPL-PRODI yang dibebankan pada MK** ***ILO Program Charged to The Course***	
	3.1.3	Mampu menguasai dan mengembangkan konsep-konsep matematika bidang matematika komputasi *Able to master and develop mathematical concepts in the field of computational mathematics*
	3.2.3	Mampu mengkonstruksi algoritma komputasi untuk menyelesaikan permasalahan yang terkait *Able to construct computational algorithms to solve related problems*
	4.1.3	Mampu menerapkan pokok-pokok matematika bidang Komputasi untuk mendukung riset bidang lingkungan, pemukiman, kelautan, energi, atau teknologi informasi *Able to apply mathematical principles in the field of Computing to support research in the fields of environment, settlement, marine, energy, or information technology*

	4.2.2	[C3] Mahasiswa mampu menganalisis masalah matematika dalam salah satu bidang: analisis, aljabar, pemodelan, sistem, optimasi atau ilmu komputasi *Mampu melakukan uji/simulasi secara numerik untuk mengetahui kinerja suatu metode komputasi*

Capaian Pembelajaran Mata Kuliah (CPMK) */ Course Learning Outcome (CLO)* Bila CP MK sbg penjabaran kemampuan setiap Tahap Pembelajaran dalam MK maka CPMK = Sub CPMK *If CLO as description capability of each Learning Stage in the course, then CLO = Lesson Learning Outcome (LLO)*	
CPMK-1	Mampu memahami dan mengembangkan konsep dan teknik dasar pengolahan citra *Able to understand and develop concepts and basic techniques of image processing*
CPMK-2	Mampu memahami algoritma pengolahan citra dan mengimplementasikannya dengan bahasa pemrograman *Able to understand and implement image processing algorithms by using a programming language*
CPMK-3	Mampu menerapkan teknik-teknik pengolahan citra untuk aplikasi pengolahan citra yang lebih kompleks secara individu maupun dalam kelompok dalam bentuk presentasi atau makalah *Able to apply image processing techniques for image processing applications in more complex problems, either individually or in groups in the form of presentations or papers*

Peta CPL – CP MK

Map of ILO - CLO

Tuliskan peta matriks antara CPL dengan CPMK (Sub CP MK)

	CPL-1	CPL-2	CPL-3	CPL-4	CPL-5	CPL-6
CPMK-1						
CPMK-2						
CPMK-3						

Diskripsi Singkat MK

Analisis Citra Digital merupakan mata kuliah yang berisi konsep dasar matematika yang diterapkan untuk pengolahan citra serta algoritma-algoritma untuk pengolahan citra. Konsep-konsep dasar matematika yang dibahas meliputi , yaitu transfromasi fourier, transformasi wavelet dan morphological mathematical. Teknik-teknik pengolahan citra meliputi enhancement, restorasi, segmentasi dan pemampatan citra.

Short Description of Course

Digital Image Processing and Analysis is a subject which contains the basic concepts of applied mathematics for image processing and analusis image. Basic mathematical concepts covered includes Fourier transformation, wavelet transformation and mathematical morphological. Image processing techniques include enhancement, restoration, segmentation and image compression.

Bahan Kajian:
Materi pembelajaran

Course Materials:

- Pengolahan citra
- Segmentasi citra
- Analisis citra
- Pemampatan citra
- Wavelet

- *Image processing*
- *Image segmentation*
- *Image analysis*
- *Image compression*
- *Wavelets*

Pustaka

References

Utama:

1. R. C. Gonzalez and R. E. Woods, *"Digital Image Processing, Third Edition",* Pearson, 2008
2. John C. Russ, "The Image Processing Handbook, Sixth Edition", CRC Press, 2011.

Pendukung:

	1. Bhabatosh, Majumder, Dwijesh Dutta, “Digital Image Processing And Analysis”, Prentice Hall,2006 2. Gonzalez, Woods, and Eddins, “"Digital Image Processing Using MATLAB (DIPUM)", Prentice Hall, 1st edition , 2004.
Dosen Pengampu *Lecturers*	Dr. Dwi Ratna Sulistyaningrum, S.Si., M.T.
Matakuliah syarat *Prerequisite*	-

Mg ke/ *Week*	**Kemampuan akhir tiap tahapan belajar (Sub-CPMK) /** *Final ability of each learning stage (LLO)*	**Penilaian**		**Bantuk Pembelajaran; Metode Pembelajaran; Penugasan Mahasiswa; [Estimasi Waktu] /** *Form of Learning; Learning Method; Student Assignment; [Estimated Time]*		**Materi Pembelajaran [Pustaka] /** *Learning Material [Reference]*	**Bobot Penilaian /***Assess-ment Load* **(%)**
		Indikator / *Indicator*	**Kriteria & Teknik /** *Criteria & Techniques*				
(1)	**(2)**	**(3)**	**(4)**	**Tatap Muka /** *In-class* **(5)**	**Daring /** *Online* **(6)**	**(7)**	**(8)**
1	Mahasiswa mampu menjelaskan tentang ilmu pengolahan citra digital (PCD). *Students are able to explain the science of digital image processing (PCD)*	Ketepatan menjelaskan pengertian PCD, system akuisisi citra, komponen PCD dan tahapan PCD *Accuracy explains the meaning of PCD, image acquisition system, PCD components and PCD stages*	Membuat ringkasan bab 1 *Summarize chapter 1*	Kuliah Pengantar & Brainstorming *Introductory Lectures & Brainstorming*		a. Kontrak Kuliah b. Pengantar pengolahan citra digital ✓ Histori ✓ Dasar-dasar PCD ✓ Imaging modalities ✓ Komponen PCD ✓ Tahapan pada PCD **[1] : Bab 1** **[2] : Bab 1 Hal 1-19** *a. Course Contract* *b. Introduction to*	*kosong*

						digital image processing ✓ *History* ✓ *PCD basics* ✓ *Imaging modalities* ✓ *PCD components* ✓ *Stages on PCD* ***[1]: Chapter 1*** ***[2]: Chapter 1 Pages 1-19***	
2	Mahasiswa mampu menjelaskan konsep dasar pengolahan citra digital (PCD). *Students are able to explain the basic concepts of digital image processing (PCD)*	Ketepatan menjelaskan konsep dasar PCD antara lain adalah akuisisi citra, sampling, quantization dan tool matematika. *The accuracy in explaining the basic concepts of PCD includes image acquisition, sampling, quantization and mathematical tools*	Membuat tulisan tool matematika untuk PCD. *Writing math tools for PCD*	Kuliah, Diskusi kelompok, *Lecture,* *Group discussion,*		Konsep dasar PCD ✓ Format file citra ✓ Akuisisi citra ✓ Samling dan quantization ✓ Hubungan antar piksel ✓ Tool-tool matematika **[1]: Bab 2** **[2]: Bab 2 Hal 38-102** *the basic concept of pcd* ✓ *image file format* ✓ *image acquisition* ✓ *samling and quantization* ✓ *relationships*	

						between pixels ✓ *math tools* ***[1]: Chapter 2*** ***[2]: Chapter 2 pages 38-102***	
3	Mahasiswa mampu menjelaskan proses *enhancement* dalam domain spatial dan menerapkan dalam MATLAB, serta mampu membandingkan kinerja metoda-metoda untuk *enhancement.* *Students are able to explain the enhancement process in the spatial domain and apply it in MATLAB, and are able to compare the performance of methods for enhancement.*	▪ Ketepatan menjelaskan konsep enhancement pada domain spatial ▪ Ketepatan membuat program untuk enhancement pada domain spatial ▪ *Accuracy in explaining the concept of enhancement in the spatial domain* ▪ *The accuracy of making programs for enhancement in the spatial domain*	• Praktikum • Tugas • Diskusi • *Practice* • *Exercises* • *discussion*	• Kuliah • Ceramah • Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* • *Assignments*		Operasi enhancenment spatial filtering: ✓ Transformasi gray level, ✓ Histogram equalization, ✓ Correlation dan convolution ✓ Smoothing filters ✓ Sharpening filters **[1]: Bab 3 Hal 127-182** **[2]: Bab 5 Hal 270-274** *enhancenment spatial filtering operation:* *Transformasi gray level,* ✓ *Histogram equalization,* ✓ *Correlation dan convolution* ✓ *Smoothing filters* ✓ *Sharpening filters* ***[1]: Chapter 3 Page***	

						127-182 ***[2]: Chapter 5 Page 270-274***	
4-5	Mahasiswa mampu menjelaskan proses *enhancement* dalam domain frekuensi dan menerapkan dalam MATLAB, serta mampu membandingkan kinerja metoda-metoda untuk *enhancement.* *Students are able to explain the enhancement process in the frequency domain and apply it in MATLAB, and are able to compare the performance of methods for enhancement.*	▪ Ketepatan menjelaskan konsep enhancement pada domain frekuensi ▪ Ketepatan membuat program untuk enhancement pada domain frekuensi ▪ *Accuracy in explaining the concept of enhancement in the frequency domain* ▪ *The accuracy of making programs for enhancement in the frequency domain*	• Praktikum • Tugas • diskusi QUIZ 1 • *Practice* • *Assignment* • *Quiz 1 discussiom*	• Kuliah • Ceramah • Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* *Assignments*		Enhancement pada domain frekuensi : ✓ Transformasi fourier 1D dan 2D ✓ Sifat-sifat transformasi fourier ✓ Konsep pemfilteran pada domain frekuensi ✓ Smoothing filters ✓ Sharpening filters **[1]: Bab 4 Hal 221-331** **[2]: Bab 6 Hal 335-350** *Enhancement in the frequency domain: 1D and 2D fourier transforms* ✓ *Properties of the Fourier transform* ✓ *The concept of filtering in the frequency domain* ✓ *Smoothing filters* ✓ *Sharpening filters* ***[1]: Chapter 4 Page 221-331***	

						[2]: Chapter 6 Page 335-350	
6	Mahasiswa mampu menjelaskan tentang Restorasi citra dan menerapkan dalam MATLAB, serta mampu membandingkan kinerja metoda Restorasi *Students are able to explain about Image restoration and application in MATLAB, and able to compare the performance of the restoration method*	▪ Ketepatan menjelaskan konsep restorasi citra ▪ Ketepatan membuat program untuk enhancement pada domain frekuensi ▪ *Accuracy in explaining the concept of image restoration* ▪ *The accuracy of making programs for enhancement in the frequency domain*	• Praktikum • Tugas • Diskusi • *Practice* • *Exercises* • *discussion*	• Kuliah • Ceramah • Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* *Assignments*		Teori tentang cara Memper-baiki efek dari degradasi ✓ Imaging difraksi circular ✓ image motion blur ✓ photographic recording model ✓ Noise Model ✓ Inverse Filter ✓ filter wiener **[1]: Bab 5 Hal 334-374** *theory on how to remedy the effects of degradation* ✓ *circular diffraction imaging* ✓ *motion blur image* ✓ *photographic recording model* ✓ *noise model* ✓ *inverse filter* ✓ *wiener filter* ***[1]: Chapter 5 pg 334-374***	
7	Mahasiswa mampu menjelaskan bagaimana pemrosesan file warna dan	Ketepatan menjelas- kan konsep pemrosesan citra warna	• Praktikum • Tugas • Diskusi	• Kuliah • Ceramah • Diskusi		Teori tentang pemrosesan citra berwarna	

	menerapkan dalam MATLAB. *Students are able to explain how to process color files and apply them in MATLAB*	*Accuracy describes the concept of color image processing*	• *Practice* • *Exercises* • *discussion*	• Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* • *Assignments*		✓ Model warna ✓ Transformasi warna ✓ Smoothing and Sharpening ✓ Segmentasi citra warna ✓ Noise pada citra warna **[1]: Bab 6 Hal 416-473** **[2]: Bab 1 Hal 31 -59** *Theory about color image processing* ✓ *Color model* ✓ *Color transformation* ✓ *Smoothing and Sharpening* ✓ *Color image segmentation* ✓ *Noise on the color image* ***[1]: Chapter 6 Page 416-473*** ***[2]: Chapter 1 Page 31-59***	
8	EVALUASI TENGAH SEMESTER *Mid Semester Evaluation*						
9	**[C4,P3 A2][*Conceptual knowledge, Analyze*]:**	▪ Ketepatan menjelaskan konsep	• Praktikum • Tugas	• Kuliah • Ceramah		Teori transformasi wavelet	

	Mahasiswa mampu menjelaskan tentang konsep Wavelet serta peranannya pada PCD dan mengimplementasikan dalam MATLAB, serta mampu membanding-kan jenis-jenis filter wavelet *[C4, P3 A2] [Conceptual knowledge, Analyze]: Students are able to explain the wavelet concept and its role in PCD and implement it in MATLAB, and be able to compare the types of wavelet filters*	transformasi wavelet citra ▪ Ketepatan membuat program untuk penerapan wavelet untuk PCD ▪ Accuracy in explaining the concept of image wavelet transform ▪ The accuracy of making programs for the application of wavelets for PCD	• Diskusi • *Practice* • *Exercises* • *discussion*	• Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* • *Assignments*		✓ Ekspansi multiresolusi ✓ Wavelet 1D ✓ Wavelet 2D **[1]: Bab 7 Hal 483-523** *Wavelet transform theory* ✓ *Multi-resolution expansion* ✓ *1D wavelet* ✓ *2D wavelet* ***[1]: Chapter 7 Page 483-523***	
10	Mahasiswa mampu menjelaskan tentang Kompresi citra dan mengimplementasikan dalam MATLAB, serta mampu membandingkan kinerja metoda kompresi *Students are able to explain about Image compression and implement in MATLAB, and able to compare the performance of the*	▪ Ketepatan menjelas-kan konsep kompresi citra ▪ Ketepatan membuat program untuk kompresi citra dgital ▪ *Accuracy in explaining the concept of image compression* ▪ *The accuracy of creating programs for digital image compression*	• Praktikum • Tugas • Diskusi • *Practice* • *Exercises* • *discussion*	• Kuliah • Ceramah • Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* • *Assignments*		Teori tentang kompresi citra: ✓ Redudansi citra ✓ Redudansi koding ✓ Model kompresicitra ✓ Metode-metode dasar komresi **[1]: Bab 8 Hal 547-626** *Image compression theory:* ✓ *Image redundancy*	

	compression method					✓ *Coding redundancies* ✓ *Image compression model* ✓ *Basic methods of compression* ***[1]: Chapter 8 Page 547-626***	
11	Mahasiswa mampu menjelaskan konsep mathematical morphology pada PCD dan mampu mengimplementaskan dalam Matlab, serta mampu memilih teknik yang terbaik *Students are able to explain mathematical morphology concepts on PCD and are able to implement them in Matlab, and are able to choose the best technique*	▪ Ketepatan menjelas-kan konsep mathematical morphology ▪ Ketepatan membuat program pengolahan citra dengan wavelet ▪ *The accuracy of explaining mathematical morphology concepts* ▪ *The accuracy of making image processing programs with wavelets*	• Praktikum • Tugas • Diskusi • *Practice* • *Exercises* • *discussion*	• Kuliah • Ceramah • Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* • *Assignments*		Teori mathematical Morphology untuk mendeskripsikan suatu bentuk: ✓ dilation dan erosion ✓ Opening dan closing **[1]: Bab 9 Hal 649-692** **[2]: Bab 11 Hal 599-626** *Morphology mathematical theory to describe a form:* ✓ *dilation and erosion* ✓ *Opening and closing* ***[1]: Chapter 9 Pages 649-692*** ***[2]: Chapter 11 Pages 599-626***	

12-13	Mahasiswa mampu menjelaskan tentang Image Segmentation yaitu membagi gambar yang komponennya menjadi lebih kecil dan mengimplementasikan dalam MATLAB, serta mampu membandingkan kinerja metoda segmentasi. *Students are able to explain about Image Segmentation namely dividing the image whose components are smaller and implementing it in MATLAB, and being able to compare the performance of the segmentation method*	▪ Ketepatan menjelas-kan konsep segmentasi citra ▪ Ketepatan membuat program untuk segmentasi citra ▪ *The accuracy in explaining the concept of image segmentation* ▪ *The accuracy of making programs for image segmentation*	• Praktikum • Tugas • Diskusi • *Practice* • *Exercises* • *discussion*	• Kuliah • Ceramah • Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* • *Assignments*		Teori tentang image Segmentation: ✓ Deteksi tepi, garis ✓ Teori tentang thresholding ✓ boundary detection ✓ Region Growing ✓ Region splitting and merging ✓ Studi kasus **[1]: Bab 10 Hal 711-800** **[2]: Bab 7 Hal 397-436** *Image Segmentation Theory:* ✓ *Edge, line detection* ✓ *The theory of thresholding* ✓ *boundary detection* ✓ *Region Growing* ✓ *Region splitting and merging* ✓ *Case studies* ***[1]: Chapter 10 Pages 711-800*** ***[2]: Chapter 7 Pages 397-436***	
14	Mahasiswa mampu menjelaskan tentang	Ketepatan menjelas-kan konsep Representasi dan	• Praktikum • Tugas	• Kuliah • Ceramah		Teori Representasi dan deskripsi :	

	Representasi dan deskripsi citra digital dan mengimplementasikan dalam MATLAB. *Students are able to explain the representation and description of digital images and implement them in MATLAB*	deskripsi citra digital. *The accuracy in explaining the concept of representation and description of digital images*	• Diskusi • *Practice* • *Exercises* • *discussion*	• Diskusi • Praktek • Penugasan • *Lectures* • *Lecture* • *Discussion* • *Practice* • *Assignments*		✓ *chain code, quadtree, run-length* ✓ *Boundary Descriptors* ✓ *Region.al Descriptots* ✓ Studi Kasus **[1]: Bab 11 Hal 817-864** *Representation Theory and description:* ✓ *chain code, quadtree, run-length* ✓ *Boundary Descriptors* ✓ *Region.al Descriptots* ✓ *Case Studies* ***[1]: Chapter 11 Pages 817-864***	
15	Mahasiswa mampu menjelaskan tentang pengenalan dan klasifikasi fitur dan mengimplemen-tasikan dalam MATLAB, serta mampu membanding-kan kinerja metoda pengenalan.	▪ Ketepatan menjelas-kan konsep pengenalan dan klasifikasi fitur ▪ Ketepatan membuat program untuk pengenalan dan klasifikasi fitur	• Praktikum • Tugas • Diskusi • *Practice* • *Exercises* • *discussion*	• Kuliah • Ceramah • Diskusi • Praktek • Penugasan • *Lectures* • *Lecture*		Teori pengenalan dan klasifikasi fitur: ✓ Pengertian fitur ✓ ekstraksi dan seleksi ciri, ✓ Metode klasifikasi fitur **[2]: Bab 11 Hal 599-**	

	Students are able to explain the introduction and classification of features and implement them in MATLAB, and be able to compare the performance of the recognition method	▪ *Accuracy in explaining the concept of feature recognition and classification* ▪ *The accuracy of creating a program for feature recognition and classification*		• *Discussion* • *Practice* • *Assignments*		**626** *Feature recognition and classification theory:* ✓ *Definition of features* ✓ *feature extraction and selection,* ✓ *Feature classification method* ***[2]: Chapter 11 Pages 599-626***	
16	EVALUASI AKHIR SEMESTER *Final Semester Evaluation*						

TM=Tatap Muka, **PT**=Penugasan Terstuktur, **BM**=Belajar Mandiri.
***FF** = Face to Face, **SA** = Structured Assignment, **SS** = Self Study.*