MET E 5470/6470
Practical Digital Image Processing and Analysis
Spring 2024
Department of Metallurgical Engineering

Instructor:	Jiaqi Jin
Office:	WBB 410
Office Hours:	Fridays 11:00am – 12:00pm
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Pre-requisites:	None
Lecture:	M 2:00pm – 5:00pm Full Semester
Credit Hours:	3
Text(s):	Digital Image Processing: An Algorithmic Introduction using Java by Wilhelm Burger and Mark J. Burge, Springer Verlag
	Digital Image Processing (3rd Edition) by Rafael C. Gonzalez and Richard E. Woods, Prentice-Hall
	Digital Image Processing Using MATLAB, 2nd ed. by Rafael C. Gonzalez, Richard E. Woods, and Steven L. Eddins Gatemark Publishing
	Image Processing Handbook, John C. Russ, CRC
	Practical Image Processing in C, Craig A. Lindley, Wiley
	Volumetric Image Analysis, Gabriele Lohmann, Wiley
Course Description:	The course includes an introduction to the fundamentals of image processing with topics such as basic 2D image

processing, 3D image processing, quantitative analysis of images, and practical applications. Software, such as ImageJ (Fiji) and other algorithms, will be used in this class for 2D/3D analysis of multiphase systems. Advanced 2D imaging instruments, such as FTIR/Raman microscopes, and 3D imaging tool like X-ray computed tomography will also be introduced in this class.

Learning Outcomes: Understand the fundamentals of image processing and analysis.

Capability to use software to conduct 2D/3D analysis of multiphase systems.

Capability to study practical applications with 2D/3D image analysis.

Content Overview:

Topics

Introduction to Image Processing, Image Processing Fundamentals:

1. Image acquisition

2. Image file formats

3. Software – ImageJ (Fiji), MIPAV, in-house

4. Macro programming in ImageJ

Basic 2D Image Processing:

1. Point processes

2. Area processes (neighborhood and spatial processing)

3. Frame Processes

4. Geometric Processes

5. Statistical Processes

6. Supporting processes

7. Measurement (Analysis)

3D Image Processing and Analysis:

1. Volumetric tomographic data acquisition

2. Topological classification (connect component)

3. Topological thinning (3D skeletonization)

4. Distance mapping

5. Medial axis transformation

6. Morphology (watershed transform)

Practical Applications:

1. Size analysis

2. Shape analysis

3. Wall thickness analysis (foams, porous material)

4. Liberation analysis

5. Exposure analysis

6. Permeability of pore network

Grading & Evaluation Methods:		
Class/Lab Participation:	40%
In Class Quizzes:	10%
After Class Assignments:	10%
Lab Reports:	40%

Key Dates:	
Last day to add, drop (delete), elect CR/NC, or audit SEMESTER Length AND Tuition DUE – Friday, January 18
Last day to withdraw from semester length classes – Friday, March 8
Last day to reverse CR/NC option for semester length classes – Friday, April 19

Classes end – Tuesday, April 23

Readying day – Wed, April 24

Final Exam Period – Thurs-Wed, April 25-May 1

Holidays

- Martin Luther King Jr. Day holiday - Monday, January 21
- Presidents' Day holiday - Monday, February 18
- Spring break - Sun-Sun, March 10-17

Americans with Disabilities Act Statement: "The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodation in the class, reasonable prior notice needs to be given to the Center for Disability Services, 162 Union Building, 581-5020 (V/TDD). CDS will work with you and the instructor to make arrangements for accommodations."

Faculty and Students' Responsibilities: "All students are expected to maintain professional behavior in the classroom setting, according to the Student Code, spelled out in the Student Handbook. Students have specific rights in the classroom as detailed in Article III of the Code. The Code also specifies proscribed conduct (Article XI) that involves cheating on tests, plagiarism, and/or collusion, as well as fraud, theft, etc. Students should read the Code carefully and know they are responsible for the content. According to Faculty Rules and Regulations, it is the faculty responsibility to enforce responsible classroom behaviors, and I will do so, beginning with verbal warnings and progressing to dismissal from class and a failing grade. Students have the right to appeal such action to the Student Behavior Committee."