EE604: Image Processing

DR. TUSHAR SANDHAN

Instructor

- Dr. Tushar Sandhan
  - Office: EE dept, ACES 408
  - Other details: https://home.iitk.ac.in/~sandhan/
  - Teaching, creating assignments and exams
  - Evaluating theory questions

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- Teaching assistants (TA)
  - Programming assignments, MCQ, numerical Qs evaluation
  - Dedicated TA for responding email, forum queries
  - Attendance and TA management

Introduction

- Image
  - How an image is being made
  - Biological visual systems
  - Image formation models

- Processing
  - Image feature representations
  - Color and multi-resolution signal processing
  - Segmentation, denoising, compression

Topics

- EE604: Image Processing
  - Human visual system
  - Elements of visual perception
  - Image formation models
  - Sampling and quantization
  - Image enhancement
    - Spatial domain
    - Frequency domain
  - Color image processing
  - Edge detection
    - Parametric
    - Non-parametric

Topics

- EE604: Image Processing
  - Human visual system
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    - Non-parametric

- EE604: Image Processing
  - Multi-resolution analysis
  - Image segmentation
    - ML algorithms
  - Image denoising
  - Image feature spaces
  - Image quality measures
  - Image compression
  - Morphological image processing

Reference Materials

- ‘Digital Image Processing’, R.C. Gonzalez and R.E. Woods
- IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
- IEEE International Conference on Computer Vision (ICCV)
- IEEE Transactions on Image Processing (TIP)
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Prerequisites

- None
- Basics of Linear Algebra
- Basic python programming
- Imp: Fourier Transform
- Imp: Integrity

```python
# Python script to find the max
def maximum(a, b):
    if a >= b:
        return a
    else:
        return b

# inputs
a = 2
b = 4
# output
print('Max value is: ', maximum(a, b))
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maximum = lambda a, b:a if a > b else b
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➢ Do not get involved in academic misconduct or plagiarism.

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"Plagiarism is the representation of another author's art, thoughts, ideas, programming code, designs or expressions as one's own original work."

Attendance

- No weightage
- No daily attendance
- But

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- But

- sometimes random draws
  - If drawn for i^{th} class: $\alpha_i = -1\%$
- Others can fill (online form) the sample space for random draws
  - If correct sample: $\rho_i = +0.5\%$
- Final attendance
  - Percentage: $= \min(5,\ \max(-10,\ \sum_i \alpha_i + \sum_i \rho_i)\ )$

Grading Policy

- Relative grading
- A* (10), A (10), B+ (9), B (8)
- C+ (7), C (6), D+ (5), D (4), E (0), F (0), I (0)

- Assignment-1 [15%]
- Assignment-2 [15%]
- Assignment-3 [15%]
- Assignment-4 [15%]
- Quiz – 1 [5%]
- Mid-term [15%]
- End-term [20%]

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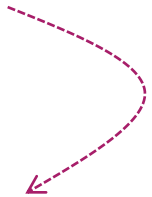

[15%] flexible, so might be added to some exams

Assignment due dates

- Lot of complications for extending due dates
  - Due to large class size
  - TAs have other work (research, courses) apart from this course
  - Unfair for those who sincerely submit on time

- Enough time will be given for each assignment

- If delayed submission ‘allowed’ in any of the assignments then only with -1% per day penalty.
  - means timely submissions are always getting rewarded

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- PG (36 credits/sem)
- UG (54~67 credits/sem)
  - Need special mentions

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- Vulnerable population (if not sincere)
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- Possibility of group projects
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➢ So irrespective of the academic calendar specifications,

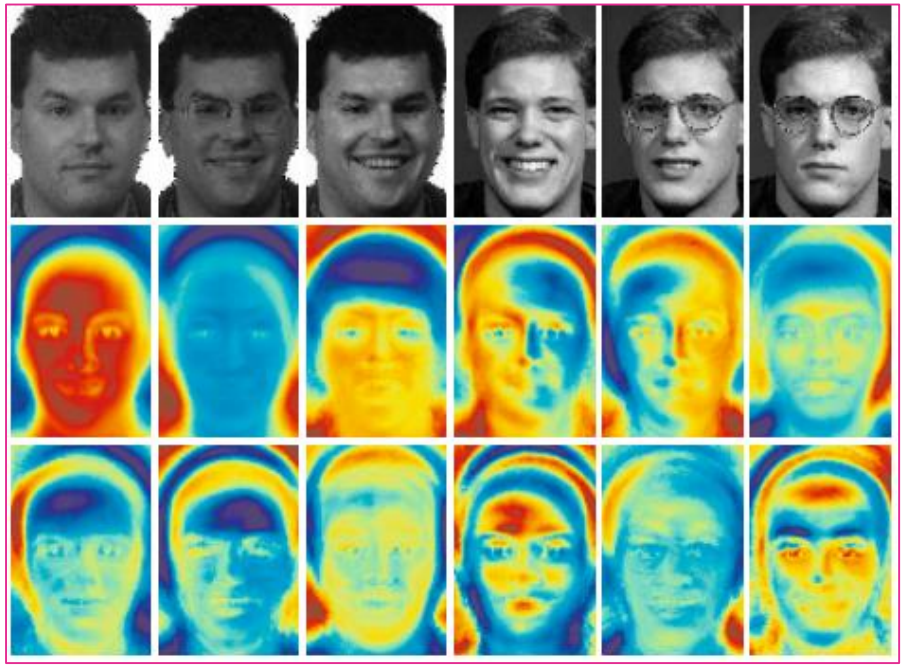
"this course dropping will not be accepted after 5th August"

- You can add-drop or drop-add whatever you want until 5th August.

(either drop early, or ride the train till the end)

Image Processing applications

- Biometrics



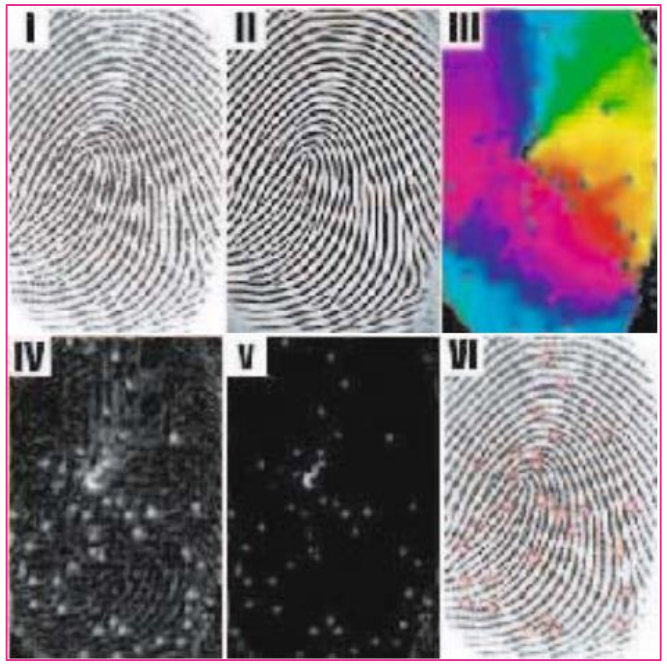
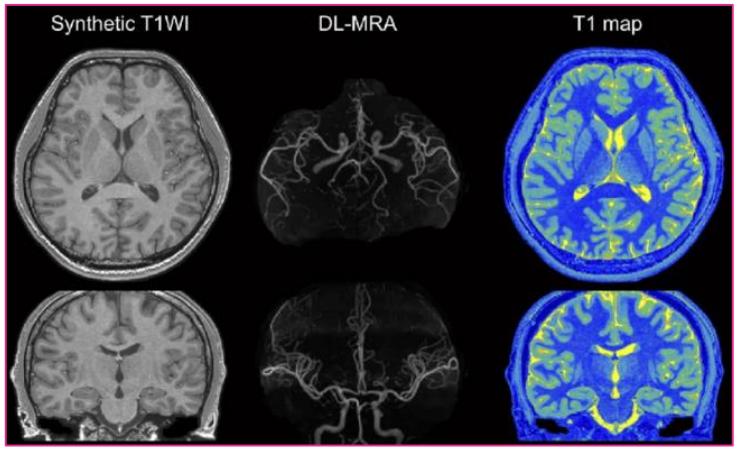
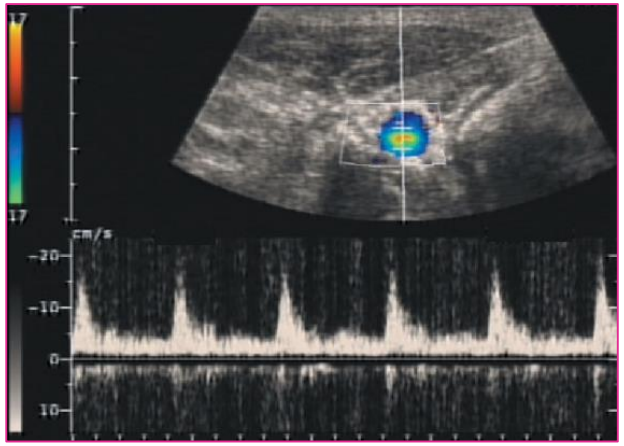


Image Processing applications

- Healthcare, biomedical image processing
  - Cancer detection





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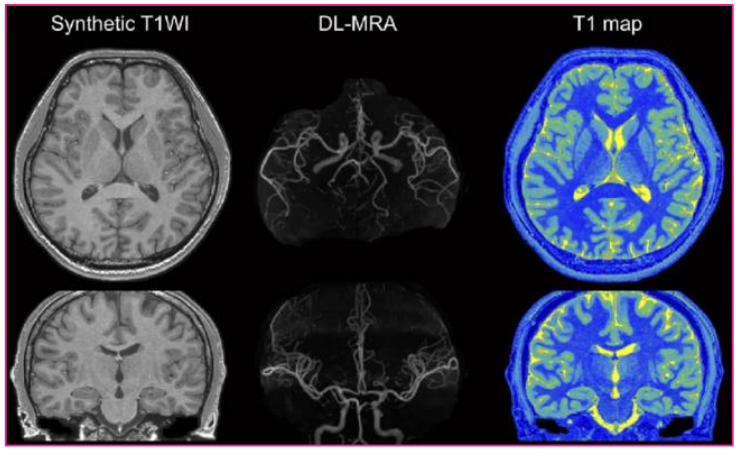
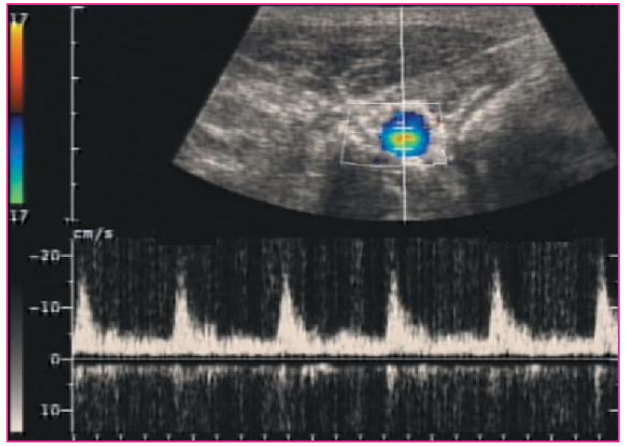




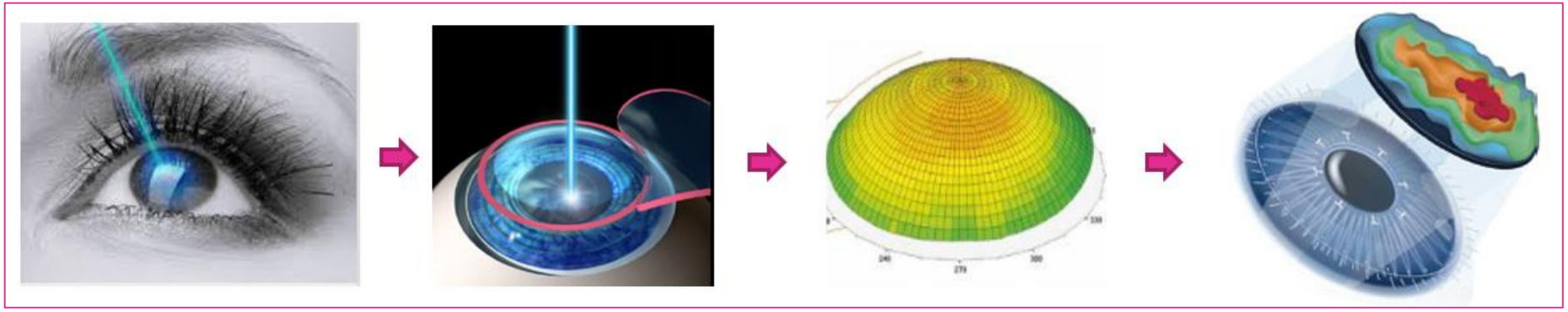
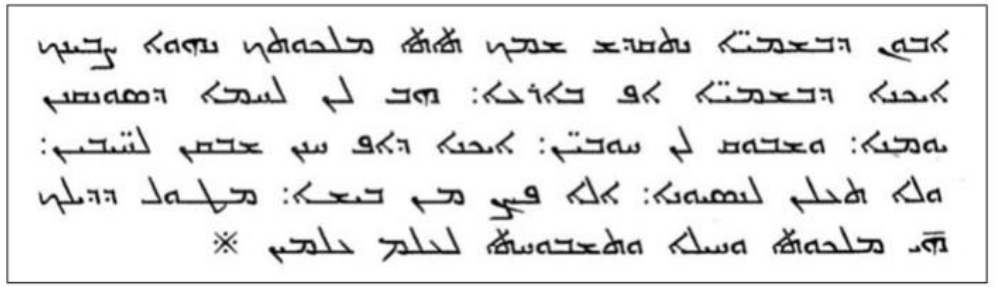
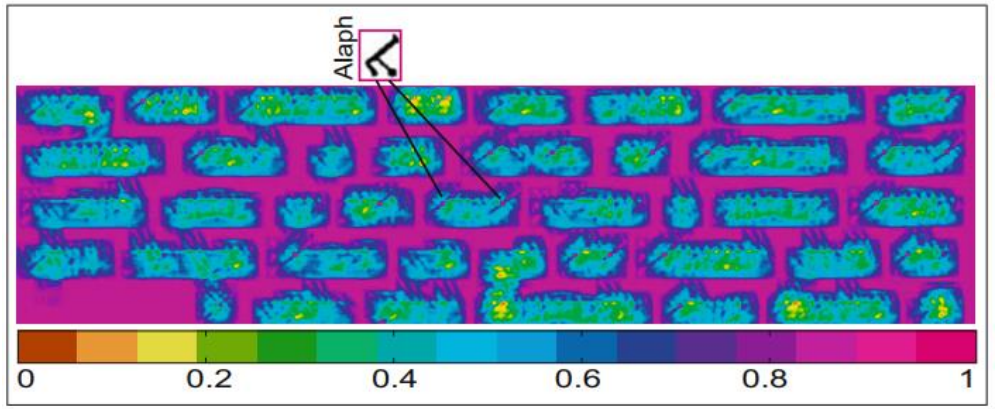


Image Processing applications

- OCR
  - aramaic





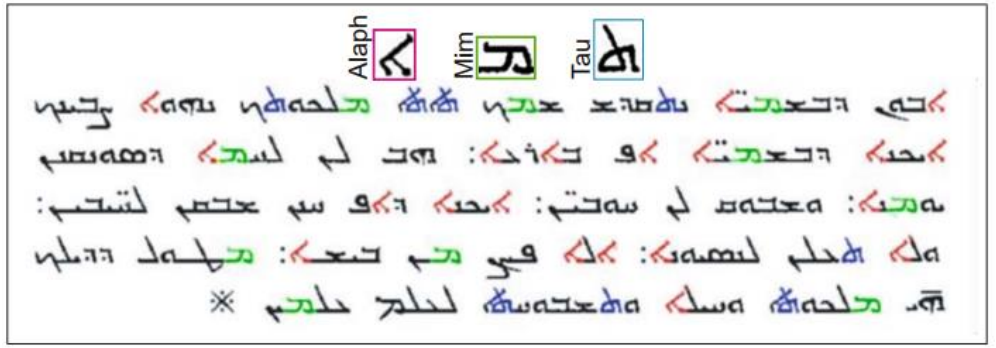
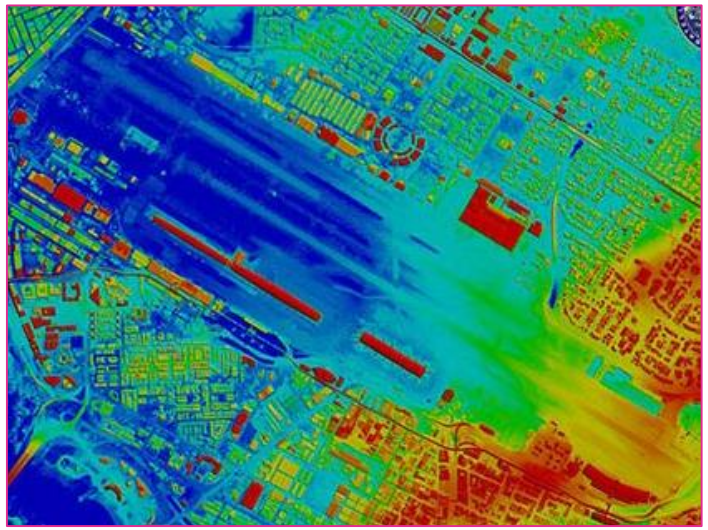


Image Processing applications

- Remote sensing



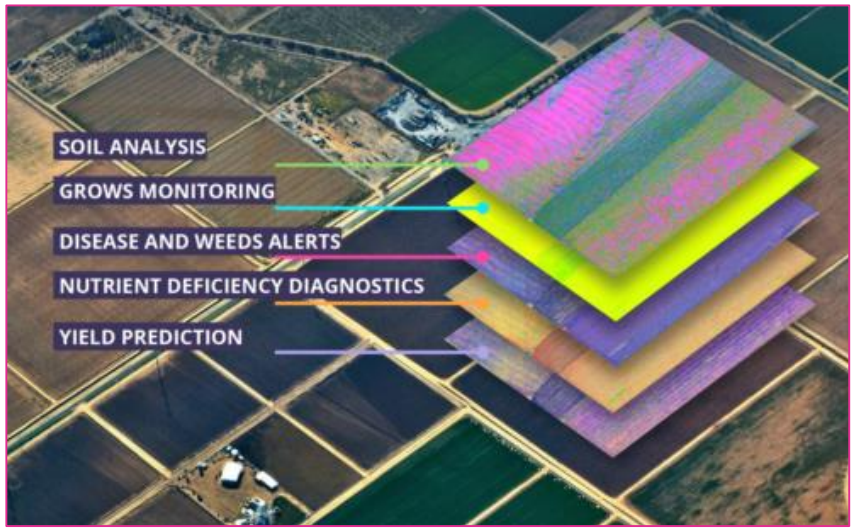


Image credit: NASA

Image credit: Marita Thushari

Image Processing applications

- Circuits to metals

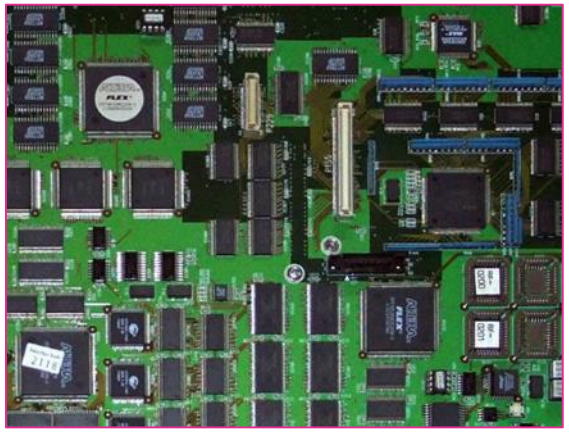
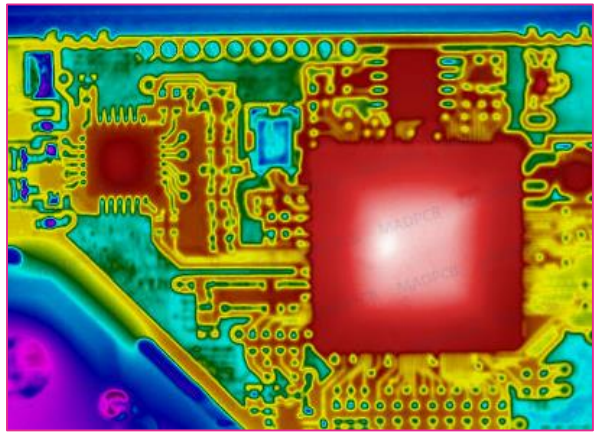
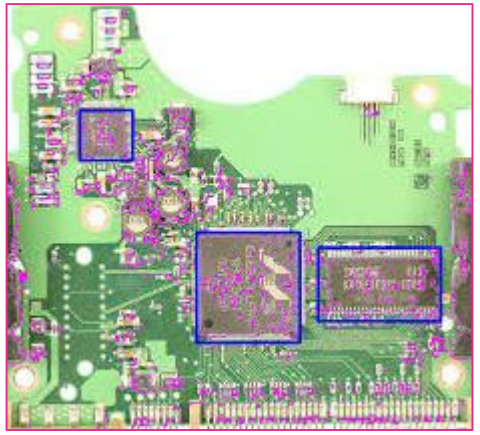
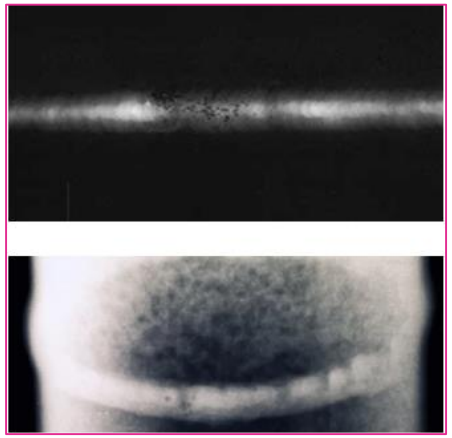
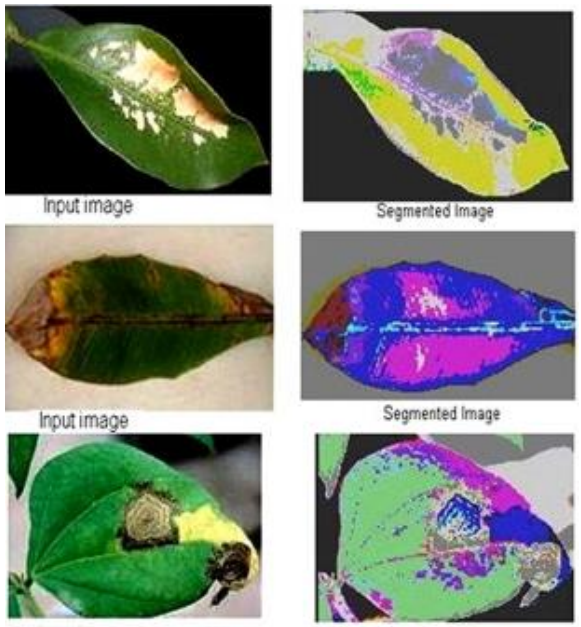





Image Processing applications

- Nature to biology



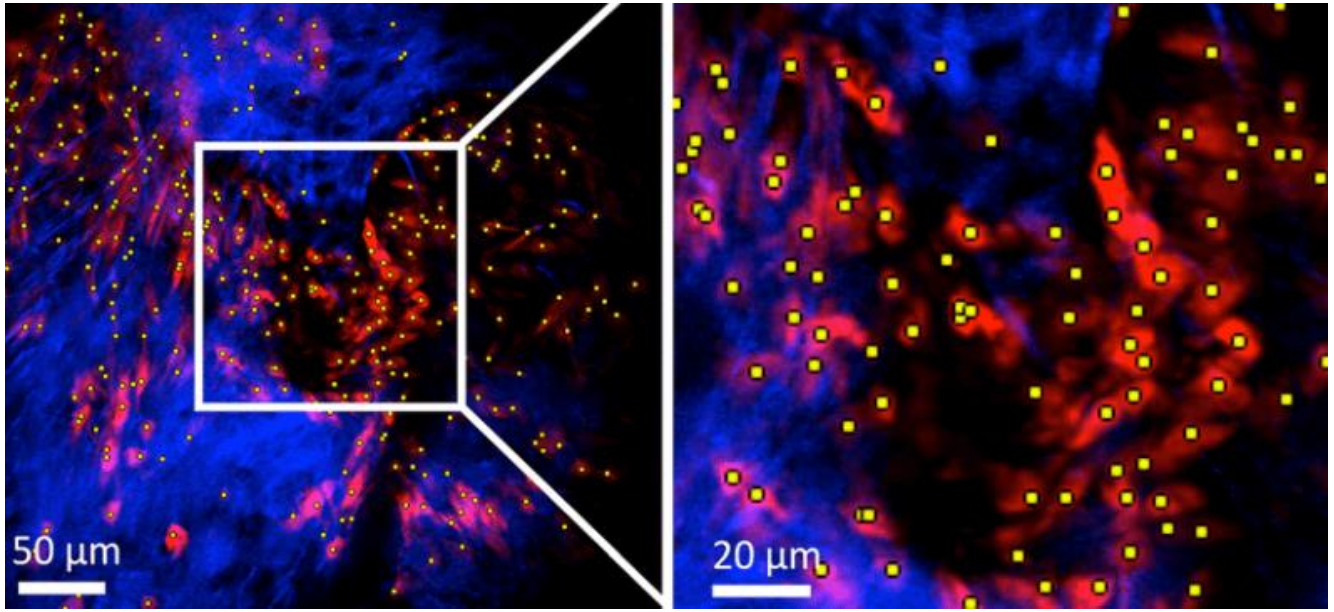
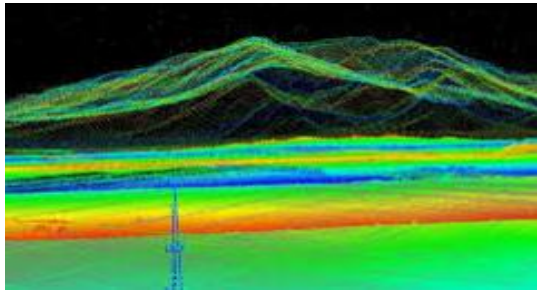


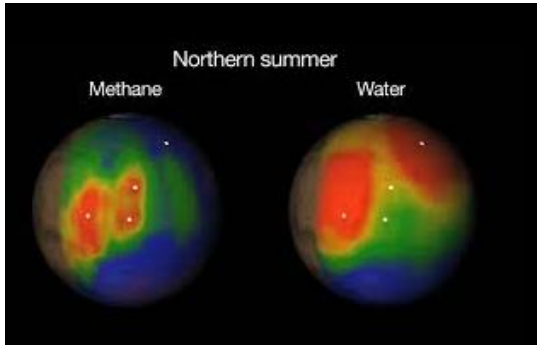
Image Processing applications

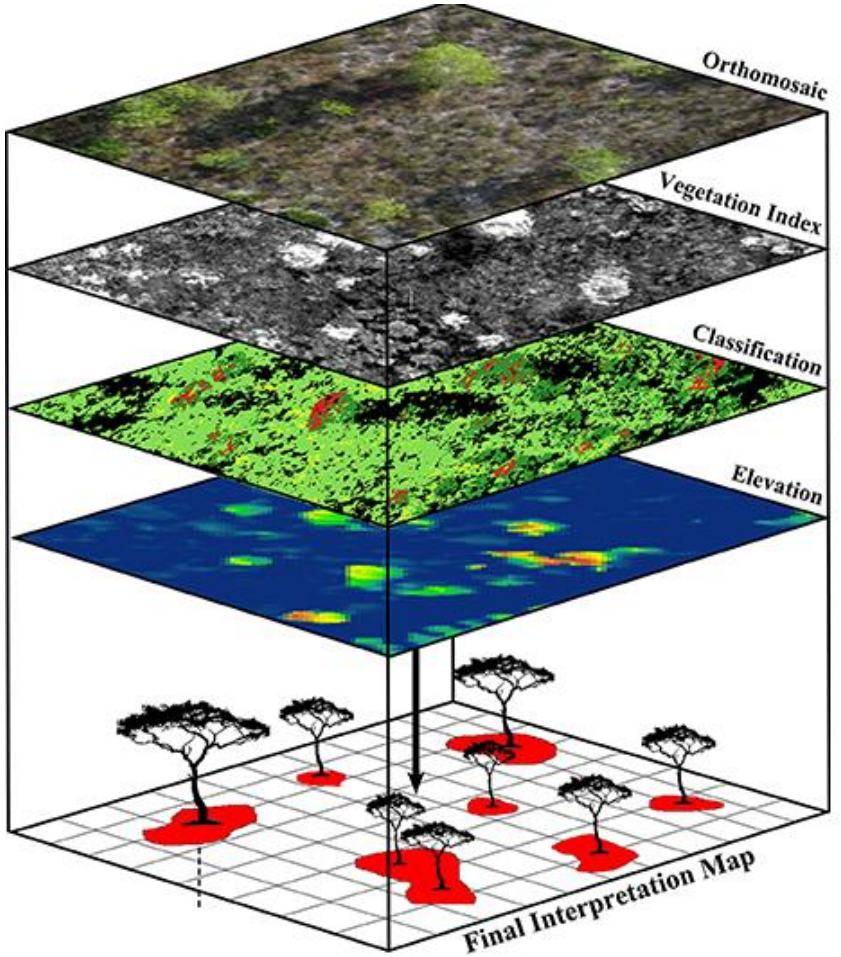
- Autonomous navigation

Image Processing applications

- Drones to satellites







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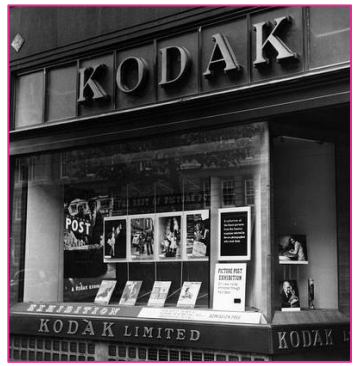

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