Digital Image Processing

Part 1: Motivational DIP

By D.J. Lopez, CCpE, M.Sc.

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Overview

- Philosophy of Images
- Machine Perception
- Why Image Processing?
- Image Processing and Data Science
- Digital Image Processing for Good

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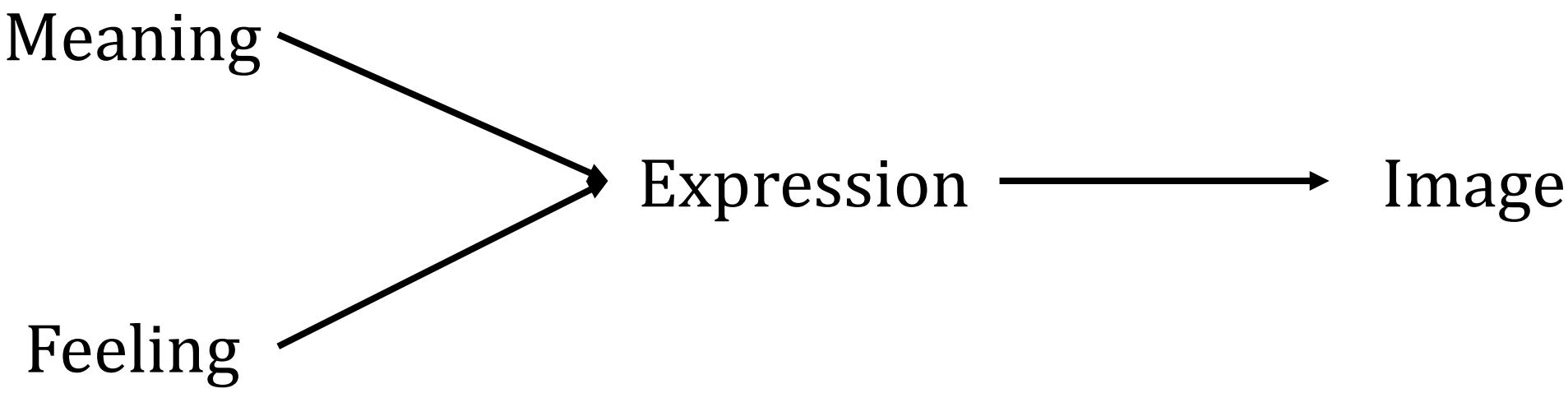
Image: A Definition

A visual representation of something



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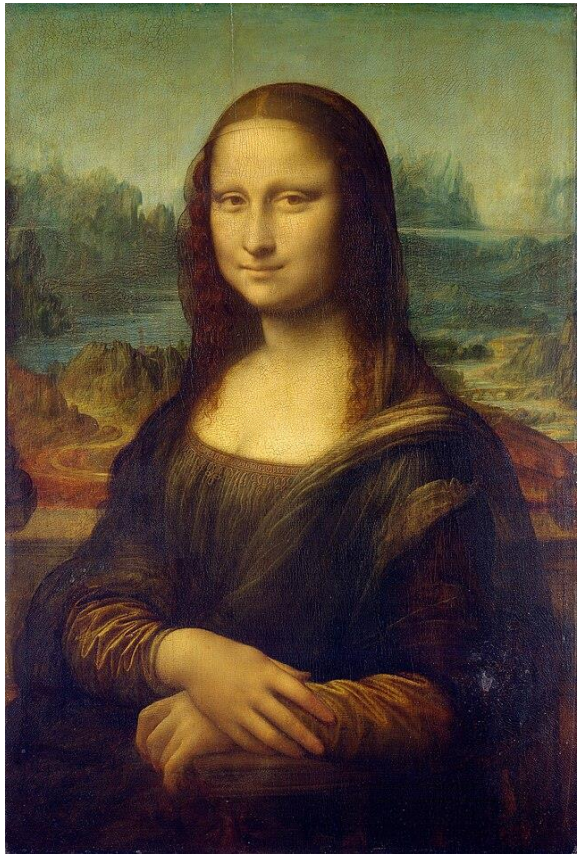
Which is/are not image/s?



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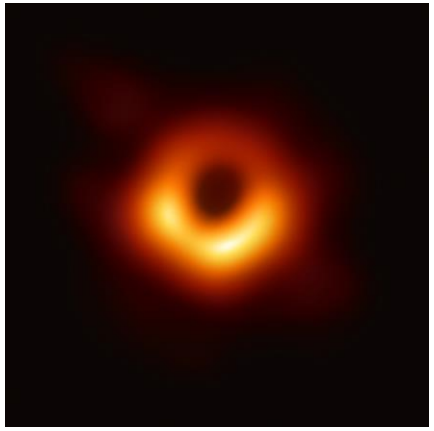

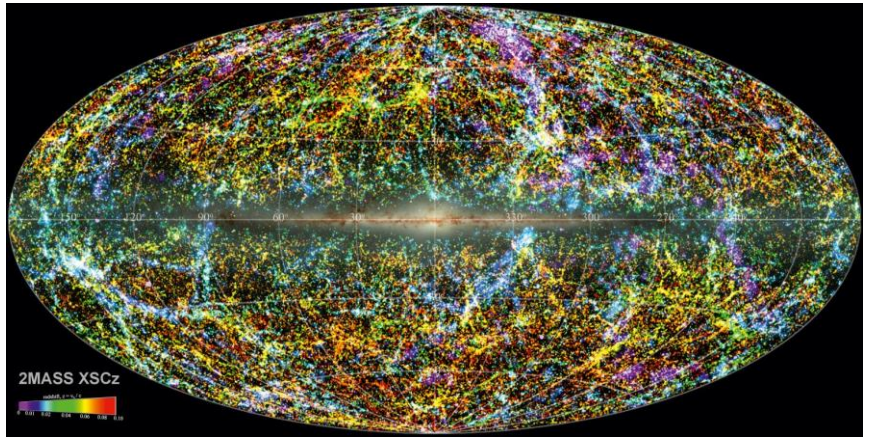

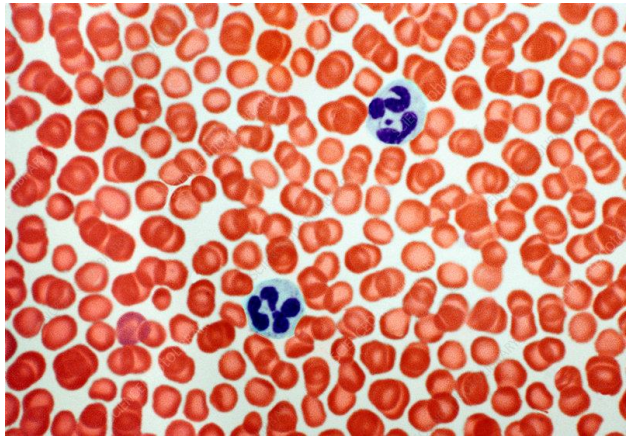

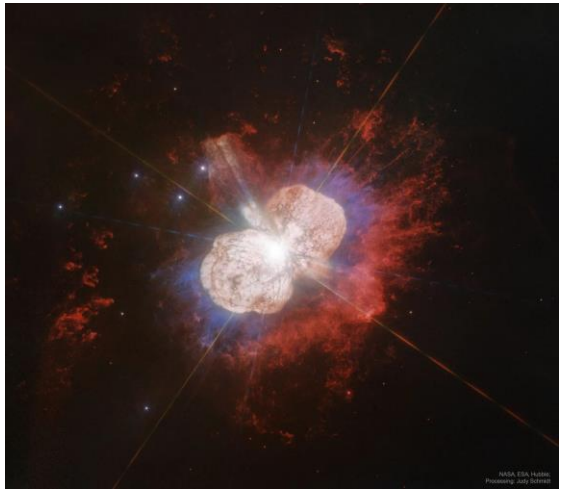

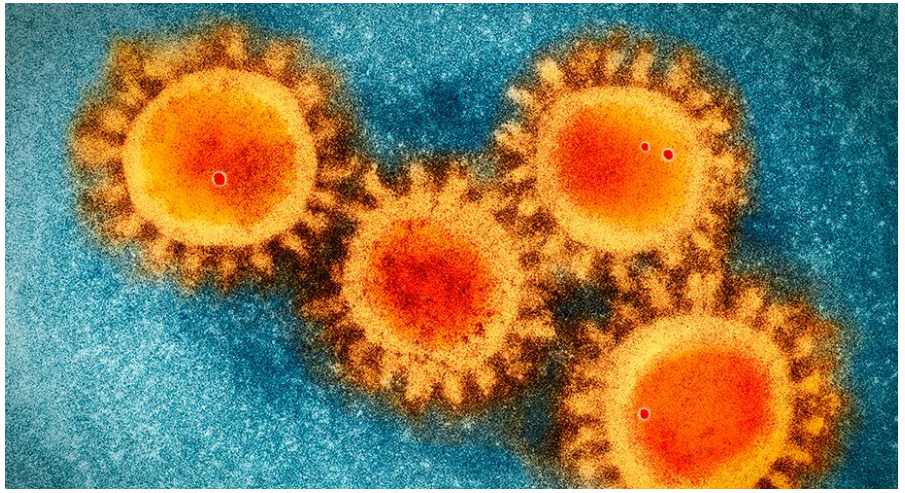

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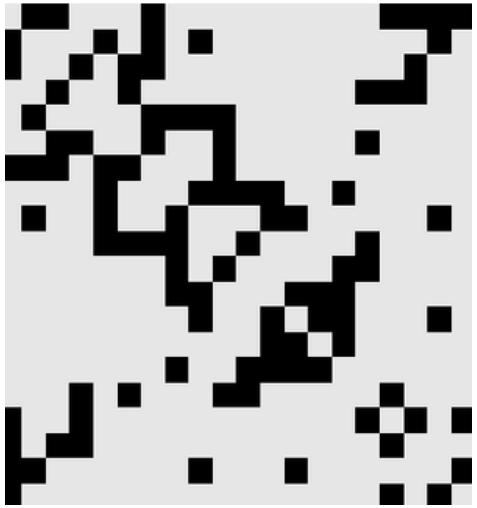
Which is/are not image/s?



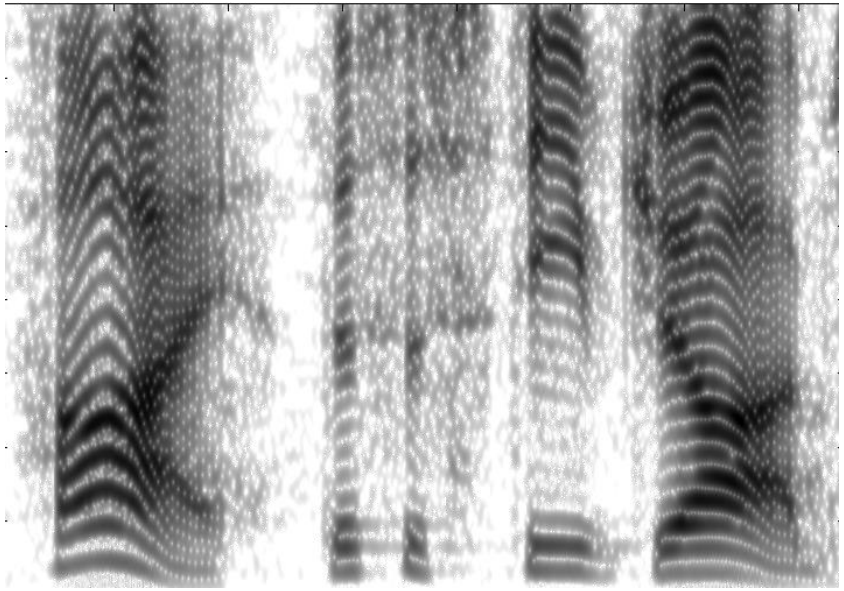


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Image Processing

Is the process of manipulating images and properties thereof to compress, enhance, modify, or to knowledge insights not limited to signal processing or mathematical techniques.

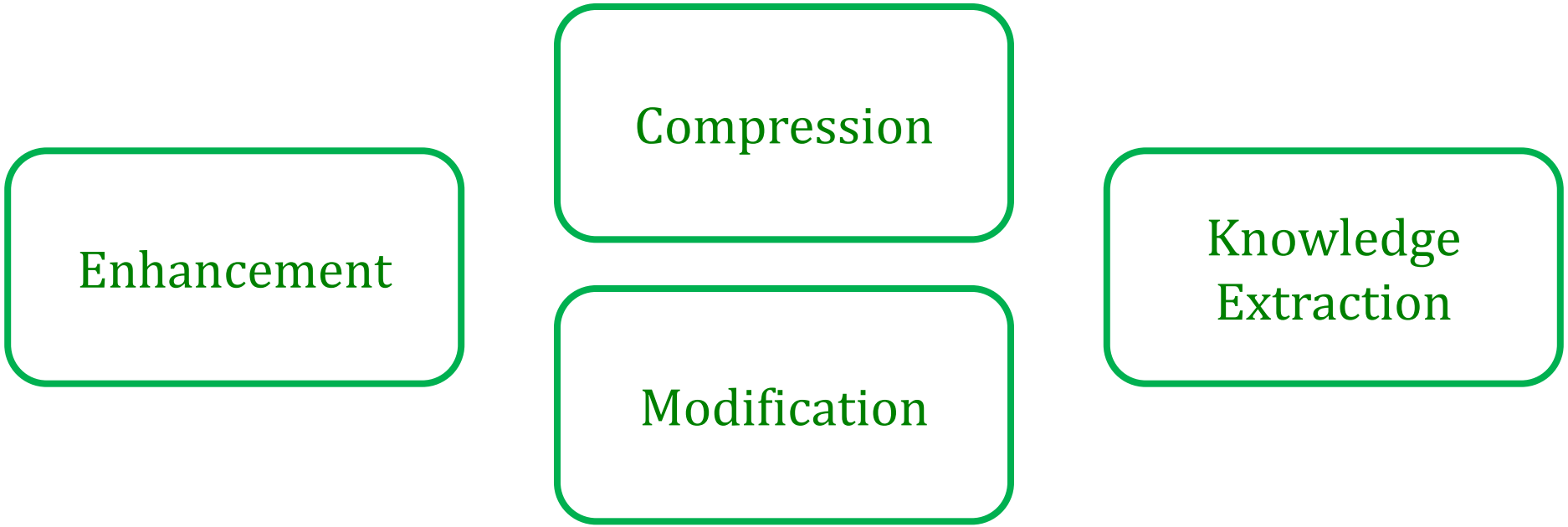

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Image Compression

Focuses on techniques for preserving image quality while reducing overall size of the digital image via efficient **pixel interpolation.** Compression may also span conversion of image formats e.g. bmp to gif to jpg formats.

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Image Enhancement

An application of image processing focused on increasing the quality of digital images. Size may not be of a concern, but it is best to consider compression as well.

Field of research may range from simple denoising to **pixel extrapolation** a.k.a super resolution.

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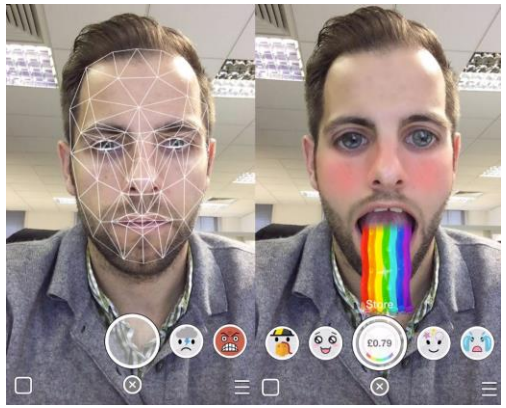
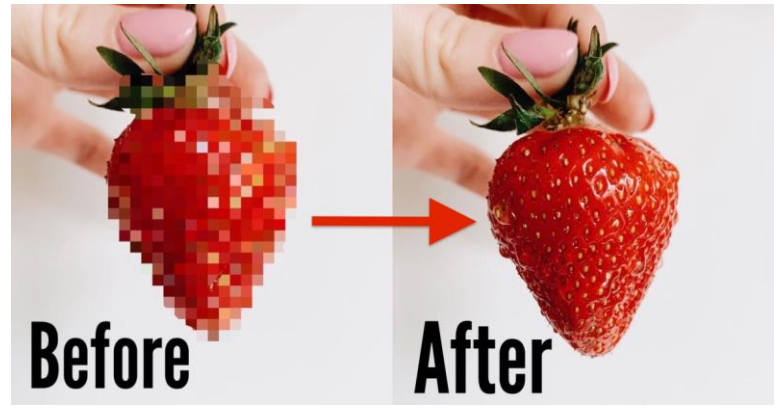
Image Modification

Modification is a broad field of image processing that may be used to elucidate or obfuscate an image for certain purposes.

(a) content image (b) style image (c) result image

Examples are censor/de-censoring, image mixing, entity removal , et cetera.





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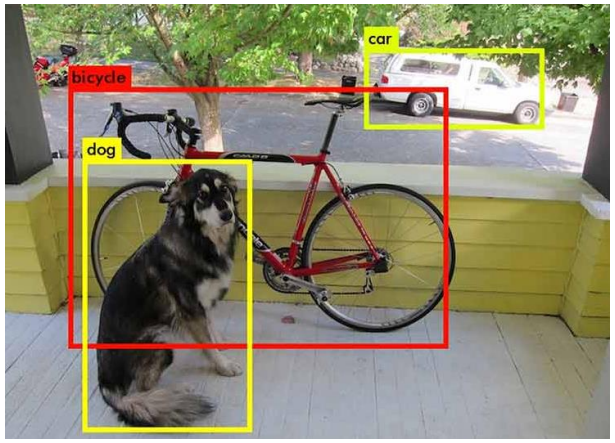
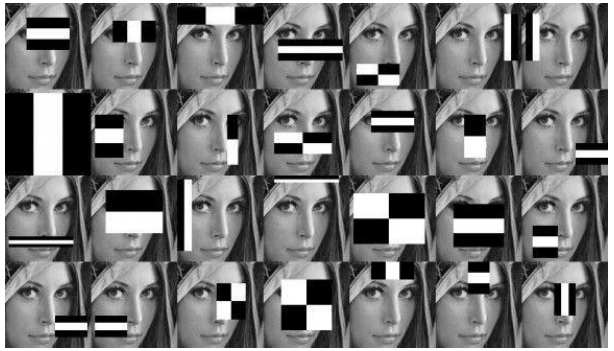
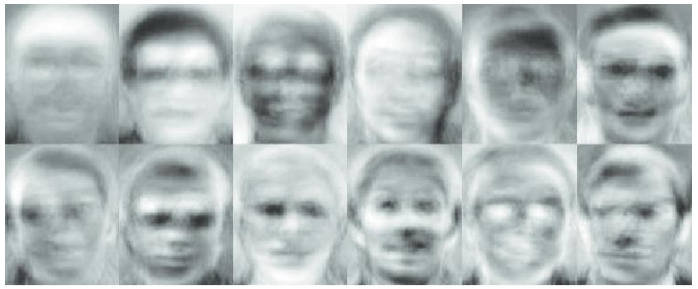
Pattern Recognition

Image pattern recognition focuses on the prediction or classification of images by **feature engineering.**

Feature engineering pertains to mathematical or biologically-inspired techniques in extracting features (essence) in an image.







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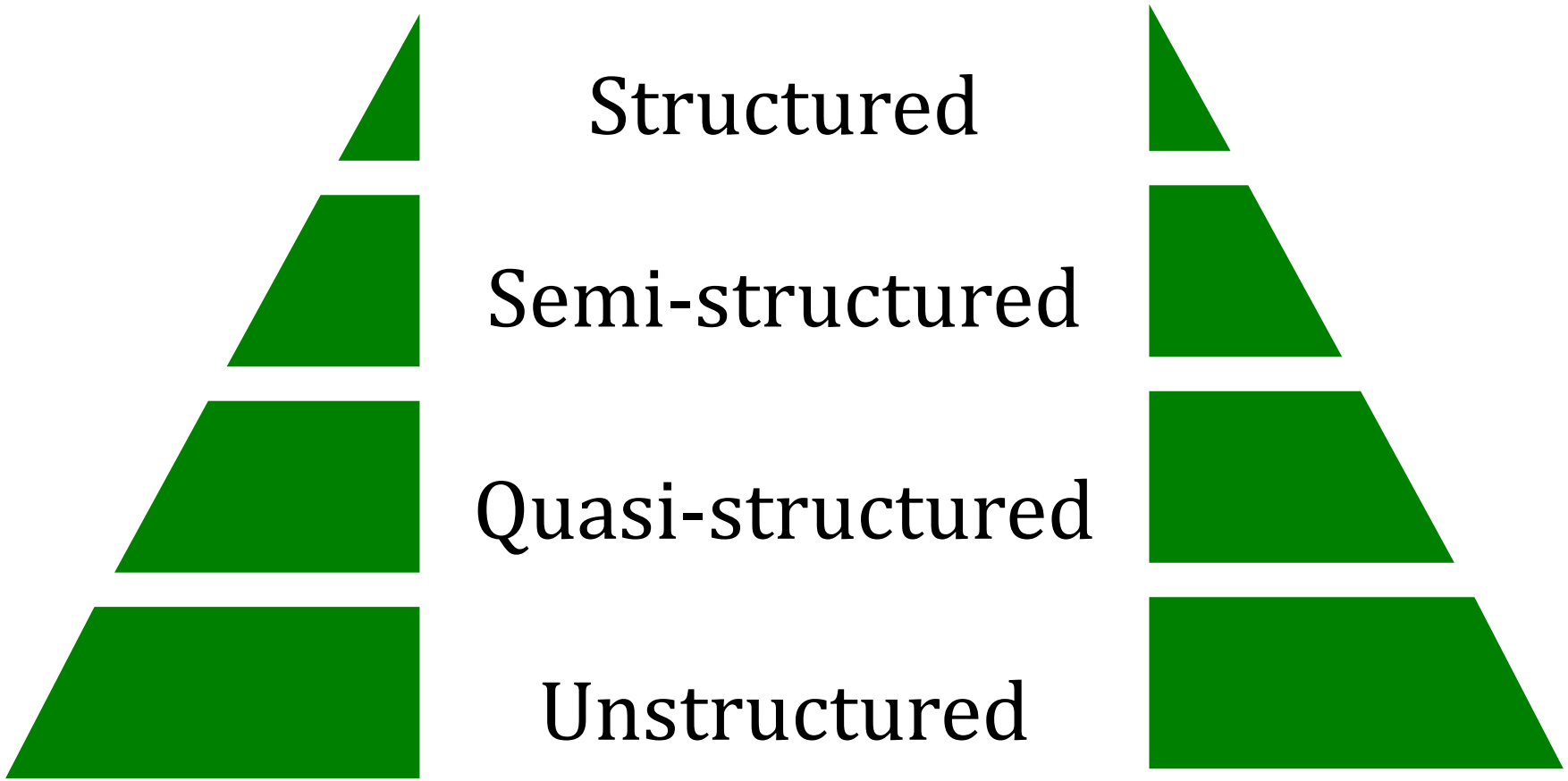
Types of Data (Acc. to Mining Difficulty)



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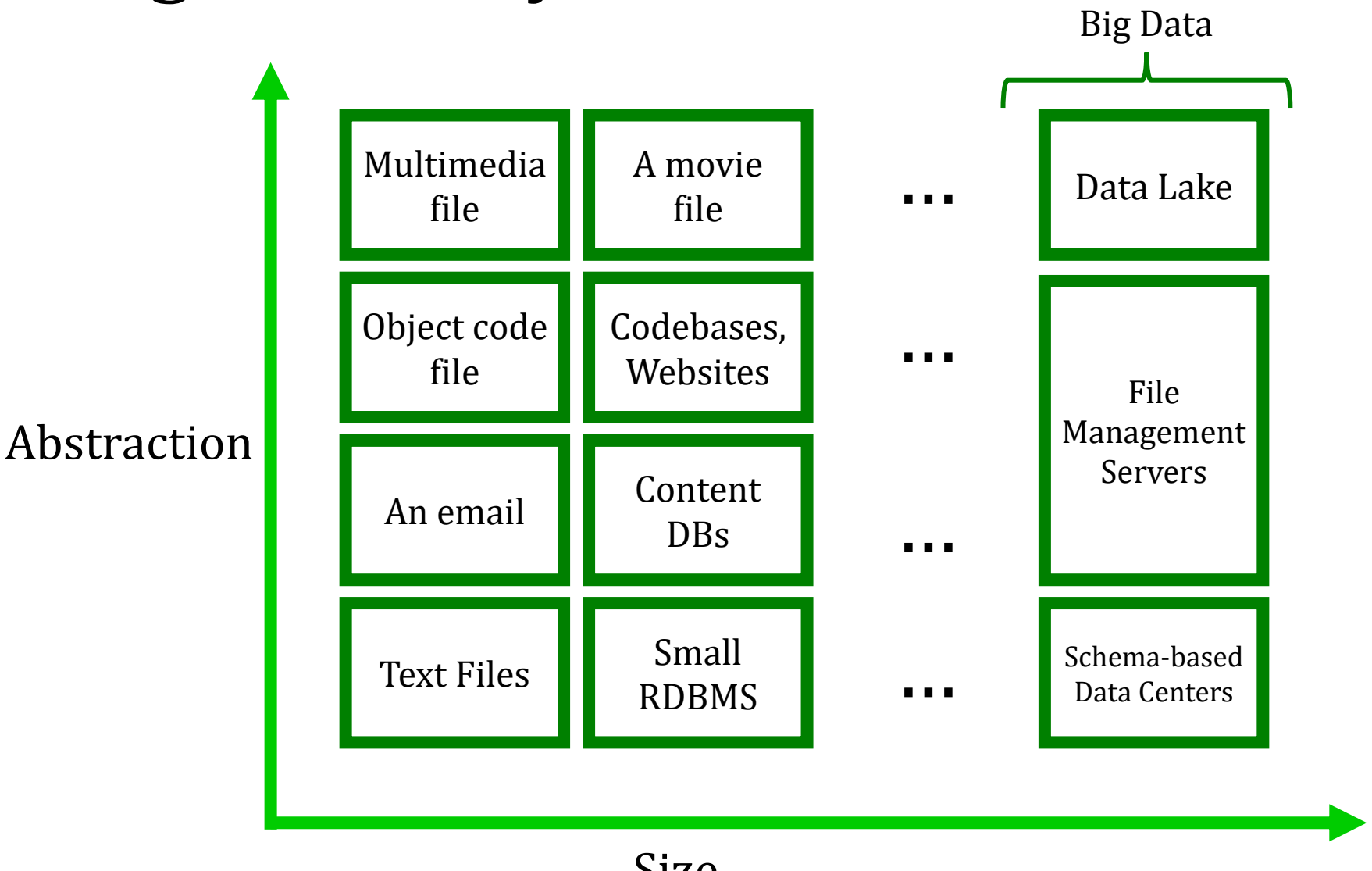
Mining Difficulty



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Types of Data (Acc. to Mining Difficulty)

Structured

Semi-structured

Quasi-structured

Unstructured

Are data that can be arranged in rows and columns preset relationships such as key-value pairs or any preset schema.

Examples:

Relational Databases (RDBMS)
Spreadsheets — CSVs, TSVs, Excel Sheets
Dictionaries (Python)
NoSQL structures

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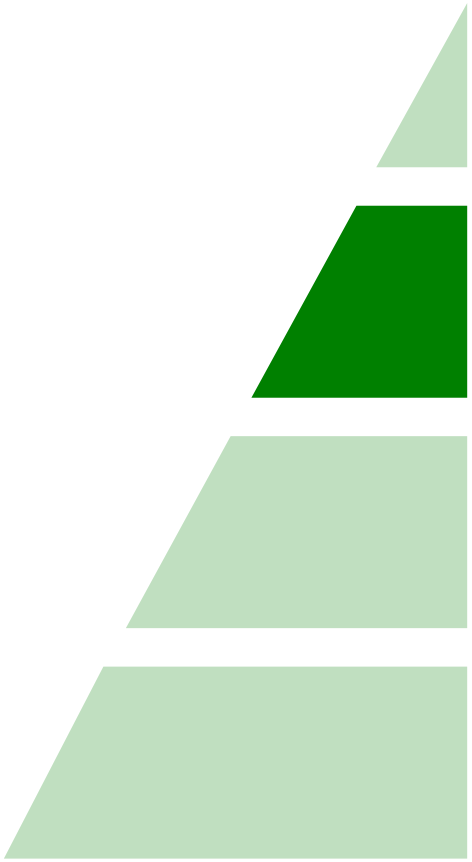
Types of Data (Acc. to Mining Difficulty)



Structured

Semi-structured

Quasi-structured

Unstructured

Data that have a general structure but may contain abstract entities such as images, texts, or audio files.

Examples:

Webpages (UI)
Dashboards
SNS Posts
Digital Files (Metadata)
Emails

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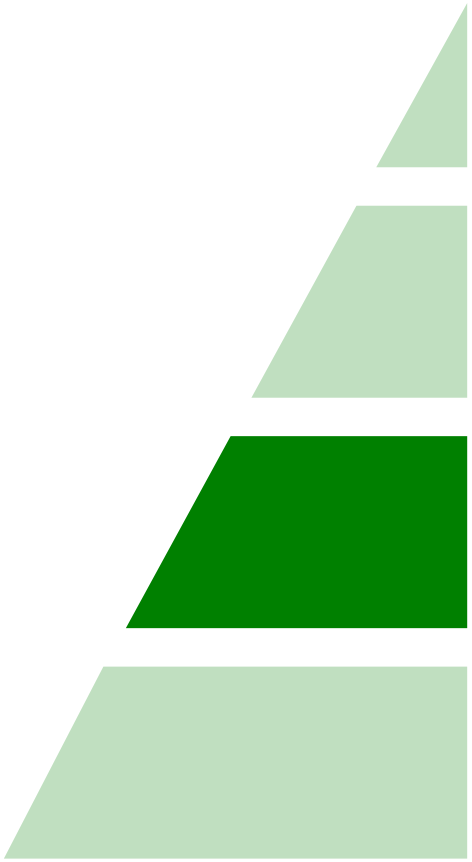
Types of Data (Acc. to Mining Difficulty)



Structured

Semi-structured

Quasi-structured

Unstructured

Data that may look erroneous at first glance. Specific compilation, processing, or technical skill is needed to comprehend the entity.

Examples:
Source Codes (Assembly, Object Code, etc)
Encrypted data
Web search results

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Types of Data (Acc. to Mining Difficulty)

Structured

Semi-structured

Quasi-structured

Unstructured

Data that can be easily interpreted by humans

Examples:
Images
Sound
Text

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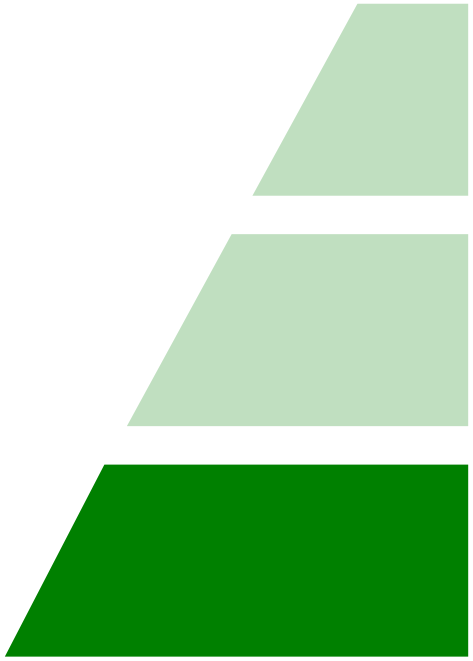
Image Interpretability



Semi-structured

Quasi-structured

Unstructured

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Image Interpretability

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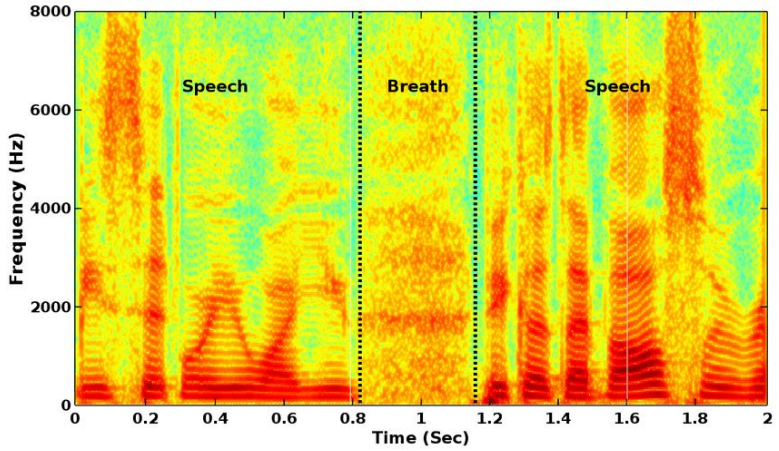

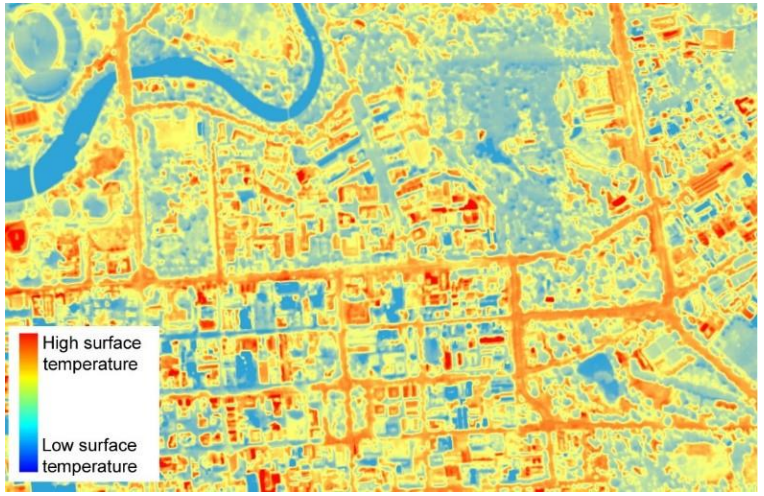

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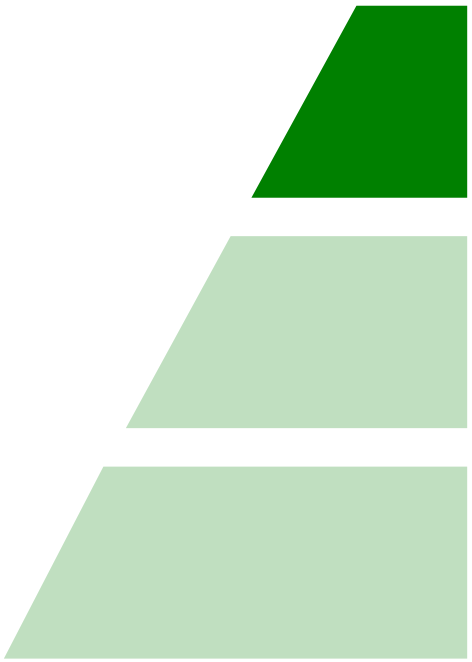
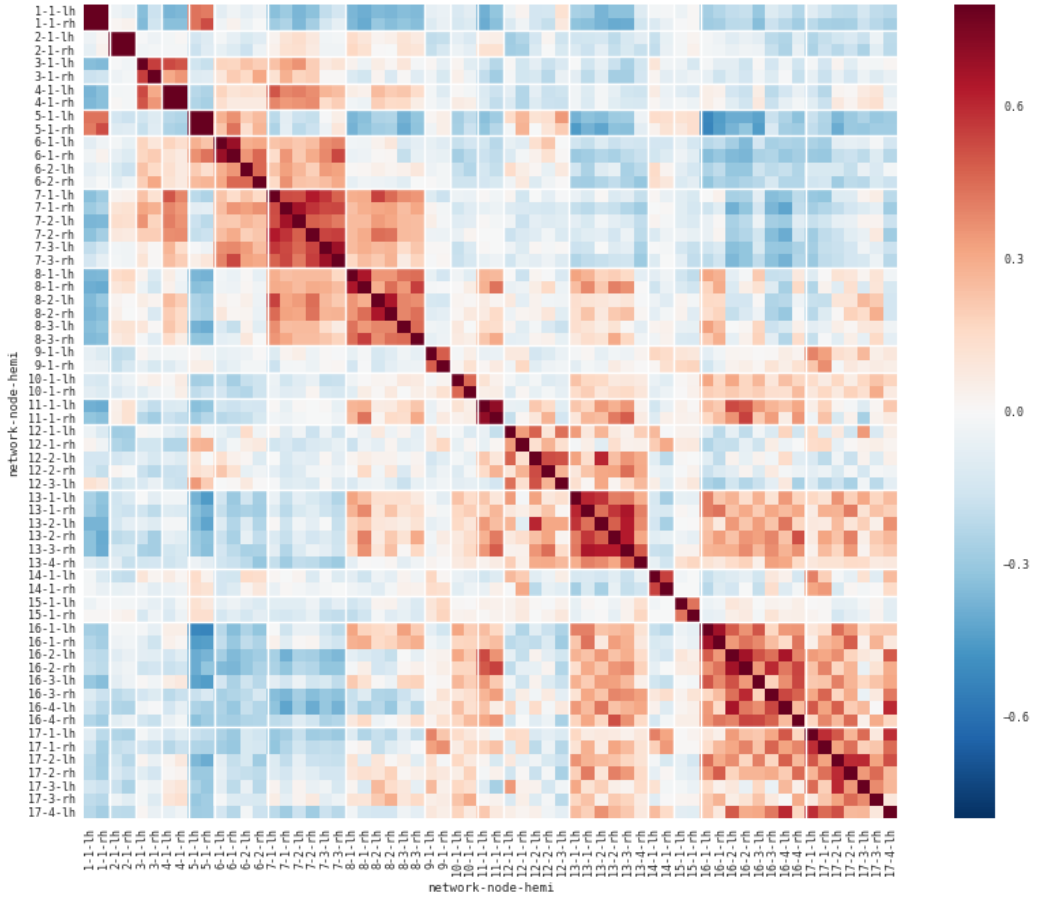
Image Interpretability



Semi-structured

Quasi-structured

Unstructured



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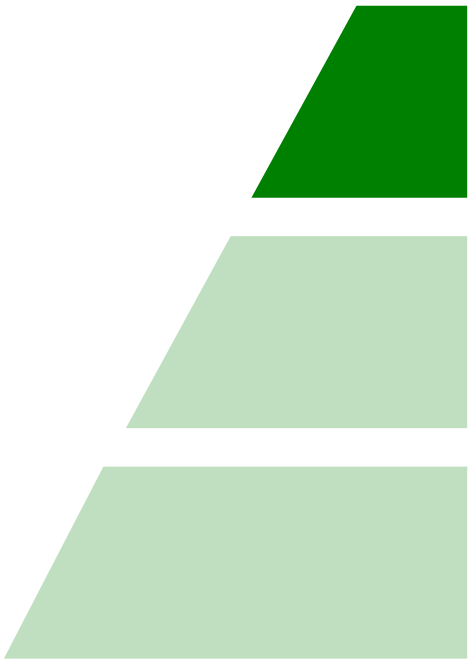

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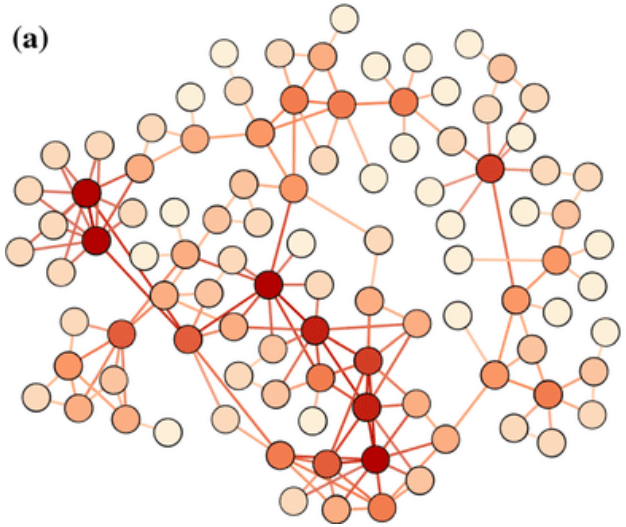

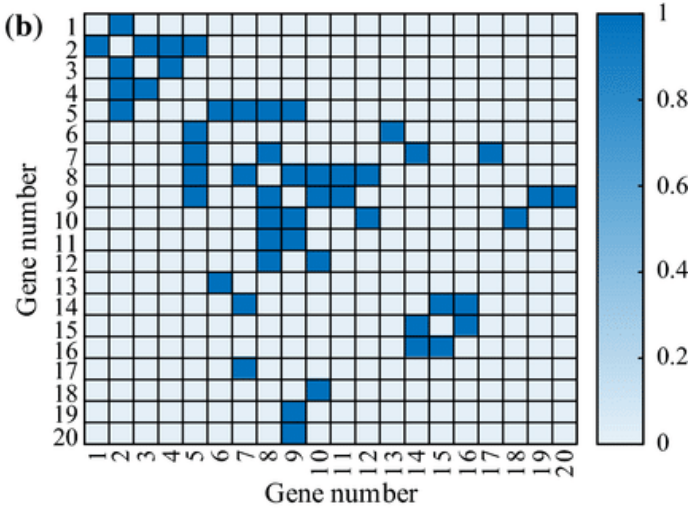

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Digital Image Processing for Good

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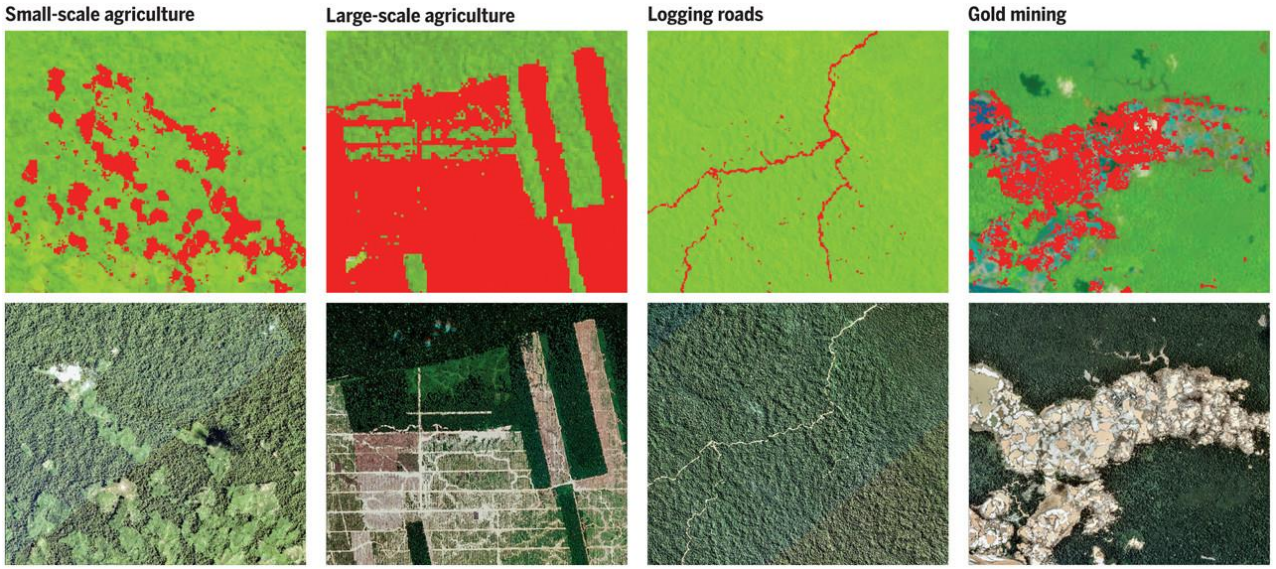
Greener Places



Possible research areas:

- deforestation mapping
- landfill mapping
- vegetation profiling

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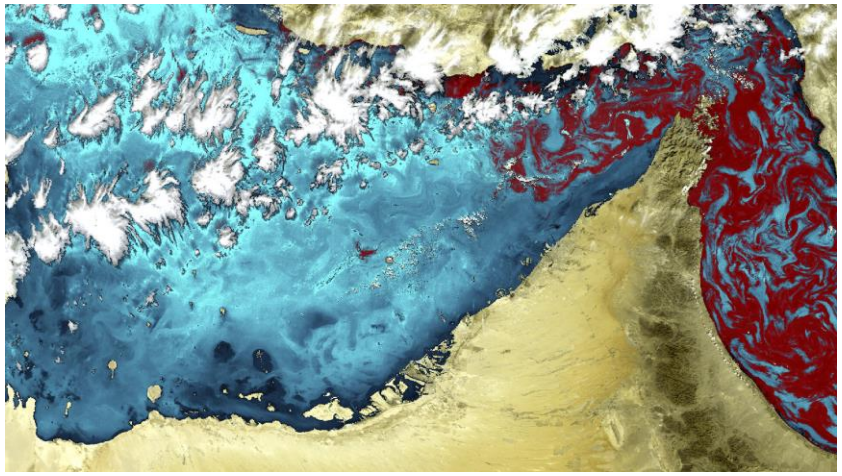
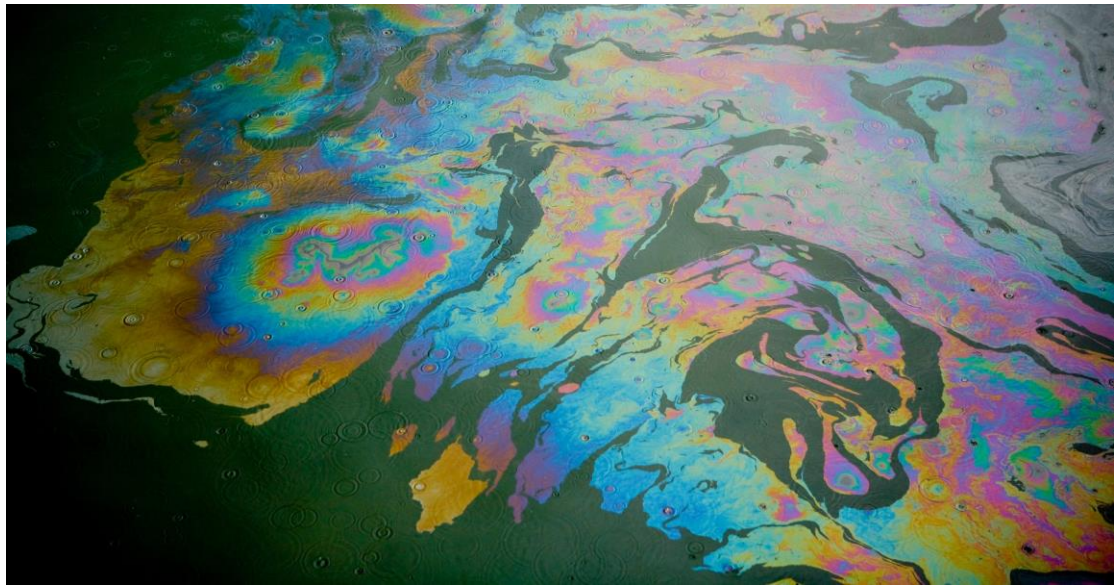
Clean Waters





Possible research areas:

- red tide mapping
- water pollution assessment
- oil spill detection

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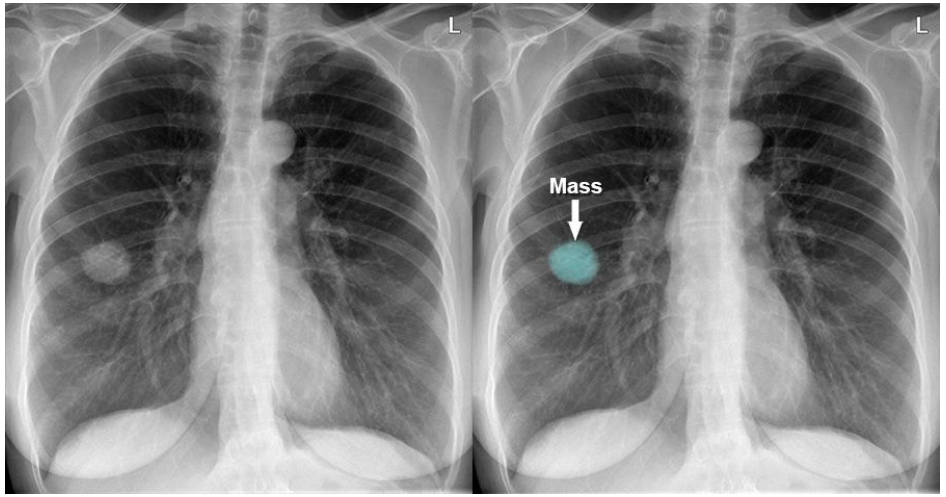
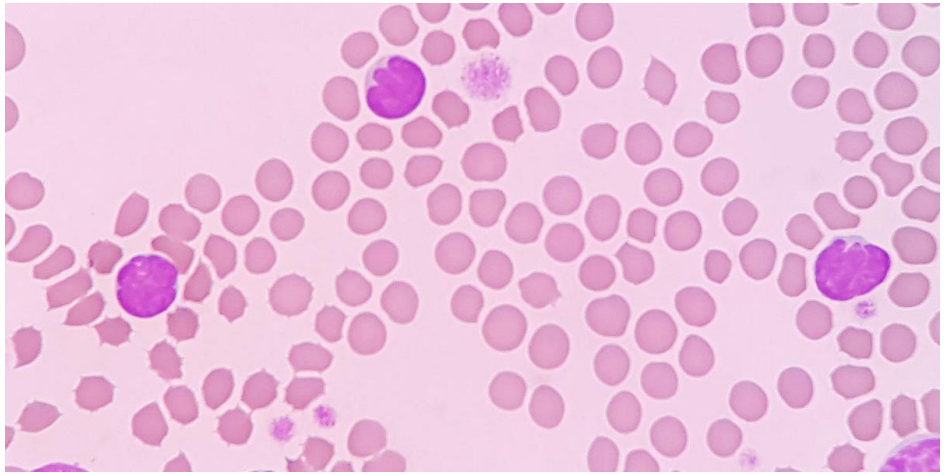
Healthier People





Possible research areas:

- cellular classification and profiling

- medical imaging-based anomaly detection

- dermatological assessment

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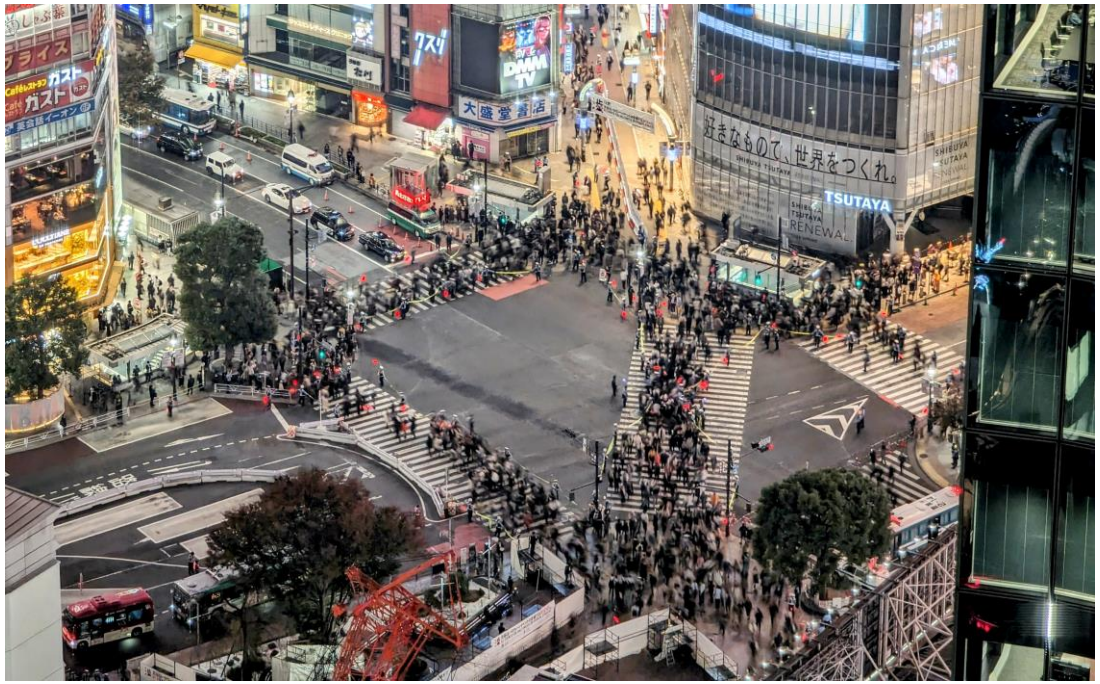
Better Living Spaces



Possible research areas:

- crowd traffic assessment
- green and brown agenda assessment
- walkability assessment

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Safer Spaces

Possible research areas:

- anomalous action detection
- crime/violence detection
- weapon detection

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Thanks

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