On the Interplay of Texture and Structure in Natural Images

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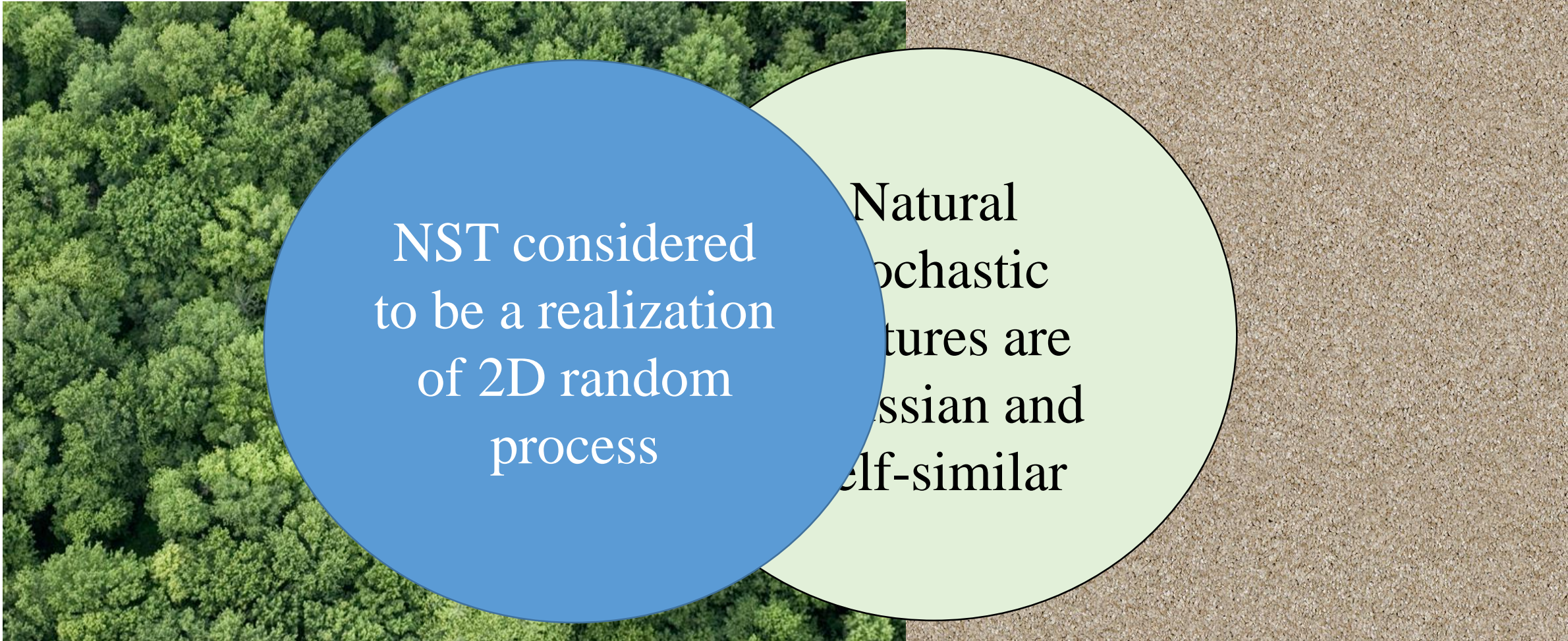*"Nobody will deny that there is at least some roughness everywhere"*
Benoit Mandelbrot
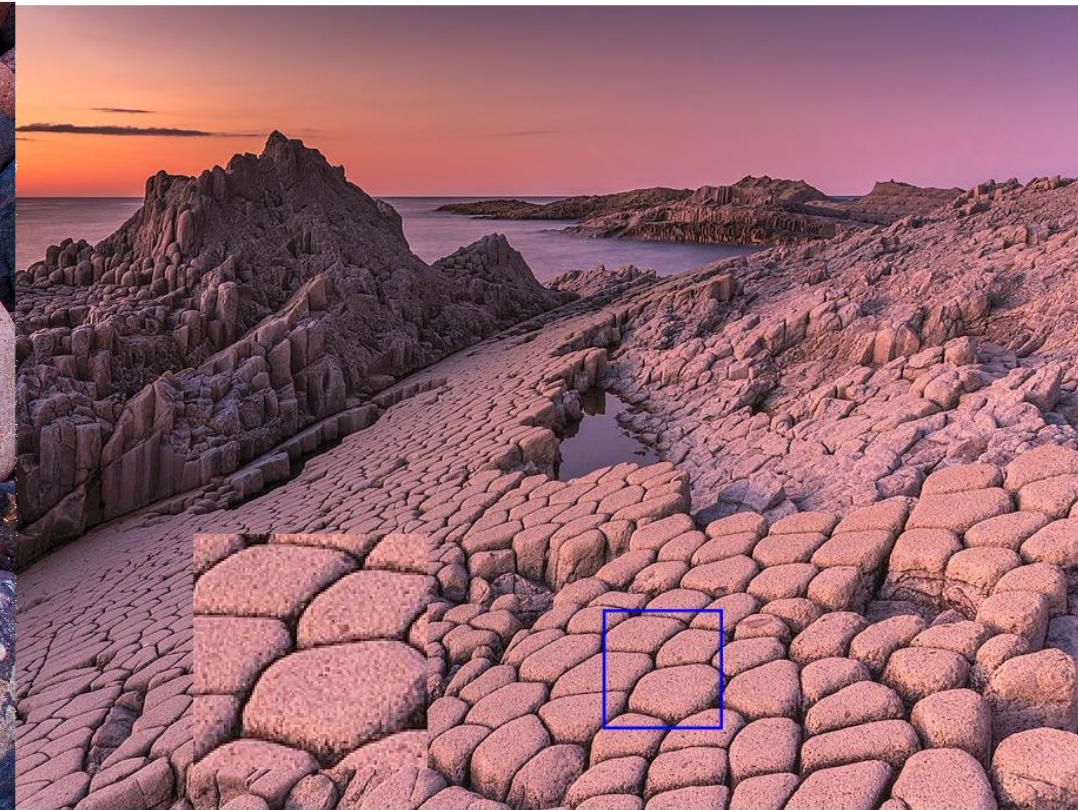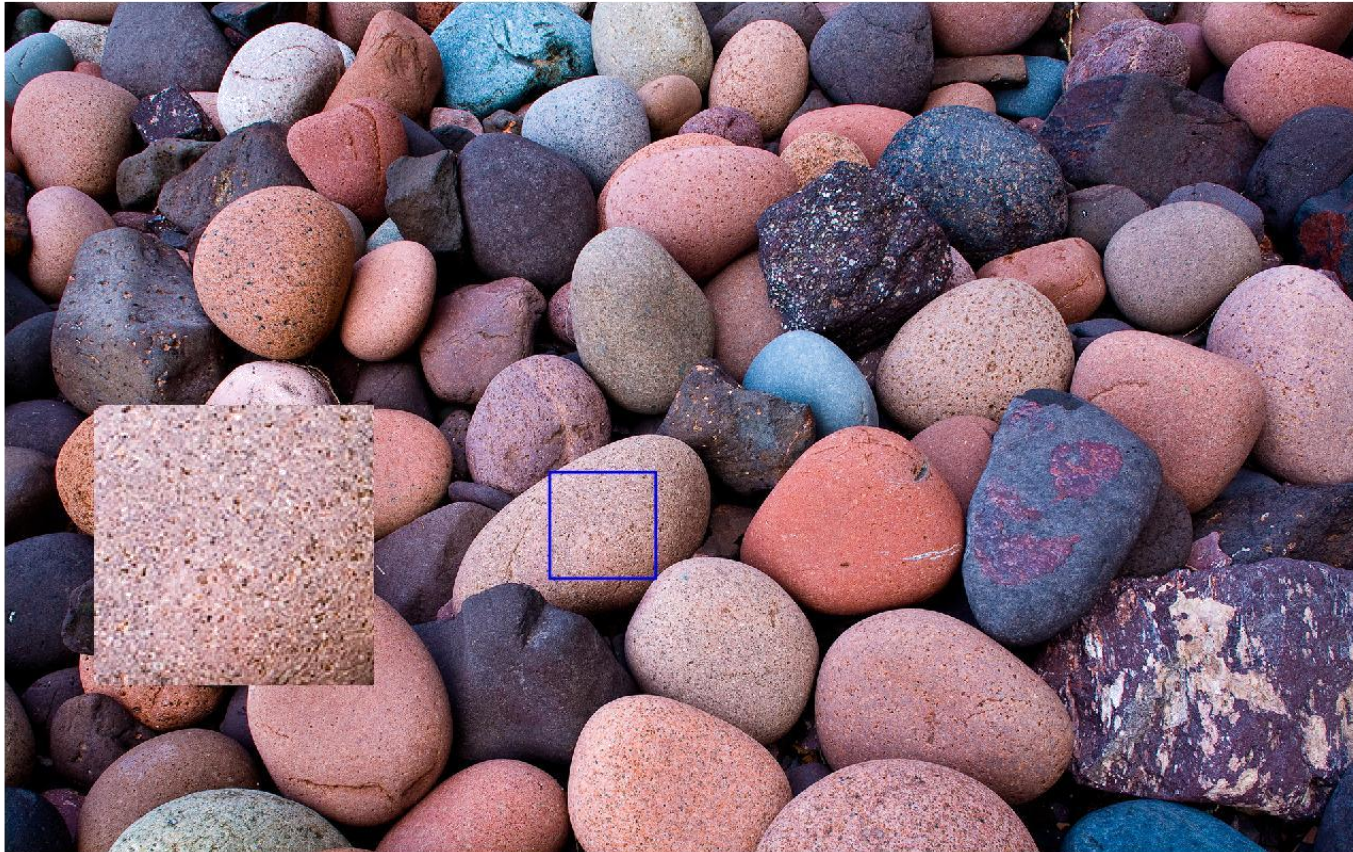
Natural Stochastic Textures

NST considered to be a realization of 2D random process

Natural Stochastic Textures are Gaussian and self-similar

Fractional Brownian Motion
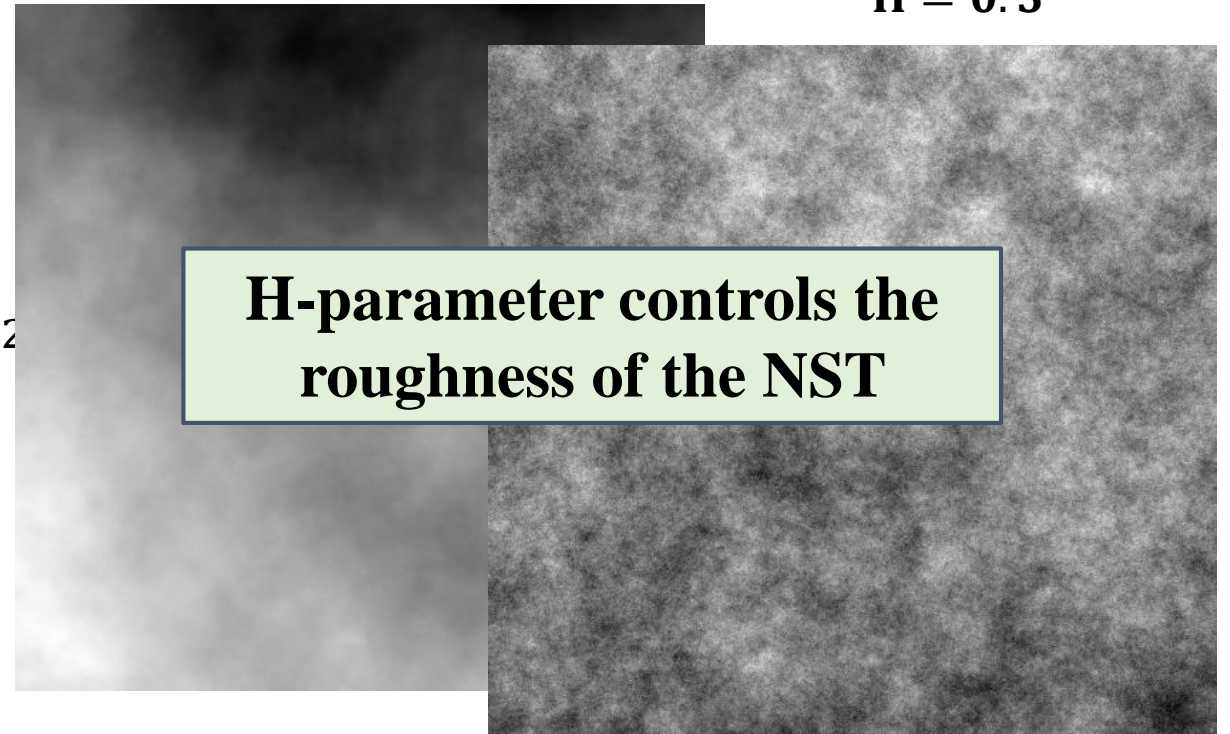
[Mandelbrot and Van Ness, 1968]

- ❑ Non-stationary Gaussian process
- ❑ Self Similar: $B_H(X) = |a|^H B(aX)$
- ❑ **Defined by a single parameter:**

  Hurst Parameter

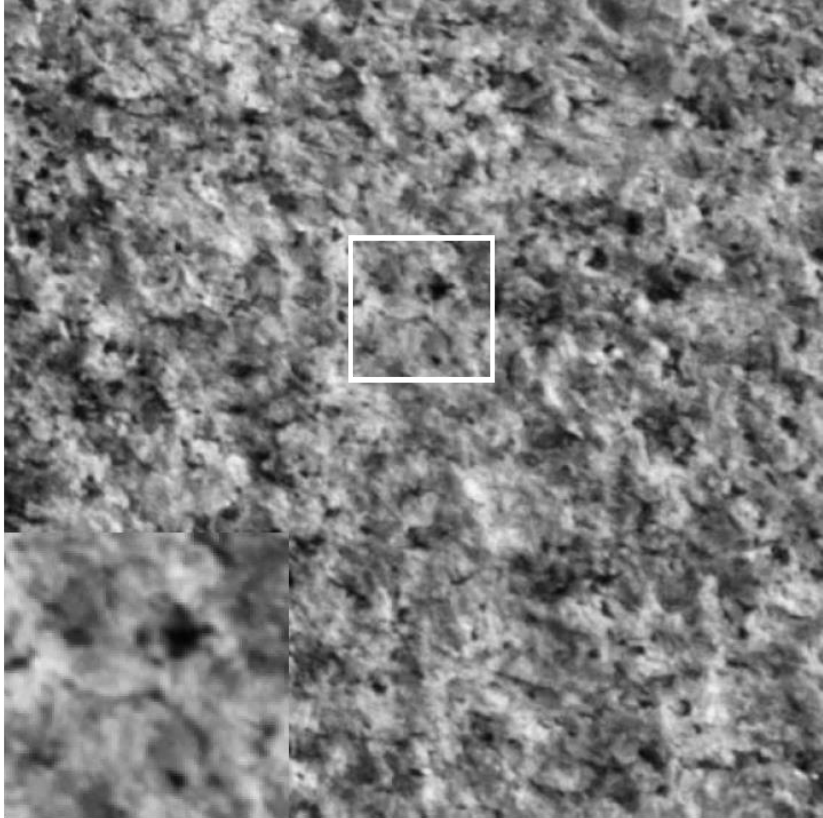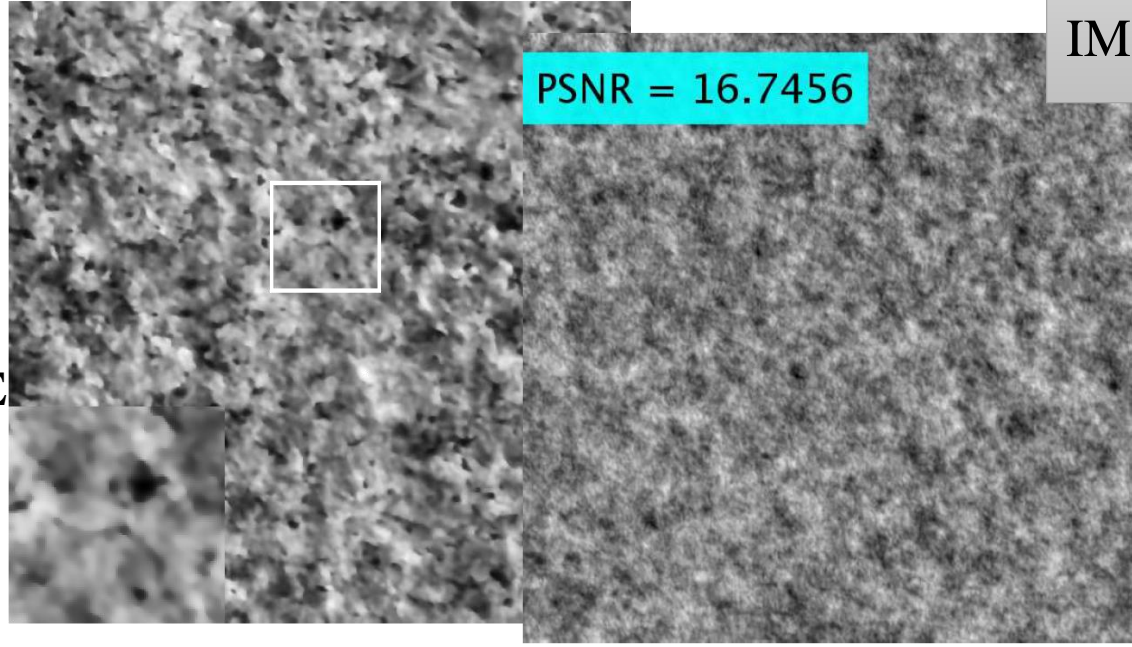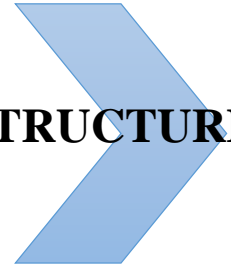$$E[B_H(t)B_H(t-s)] = \frac{\sigma_H^2}{2}\left(|t|^2\right.$$
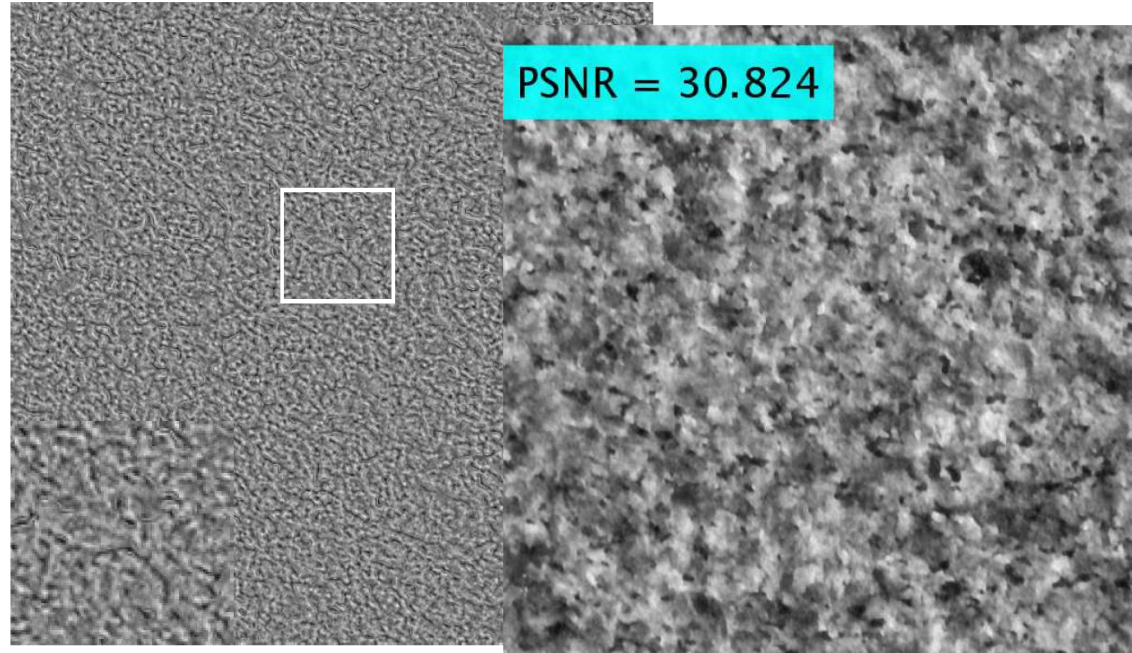
H = 0.8

H = 0.3

H-parameter controls the roughness of the NST
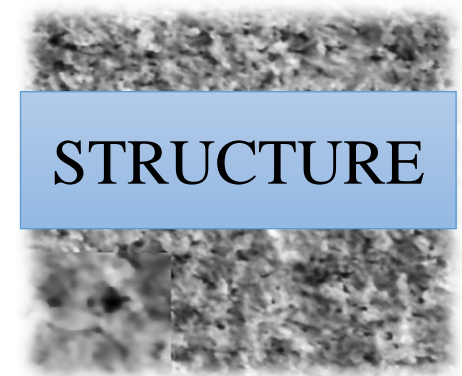
Methodology

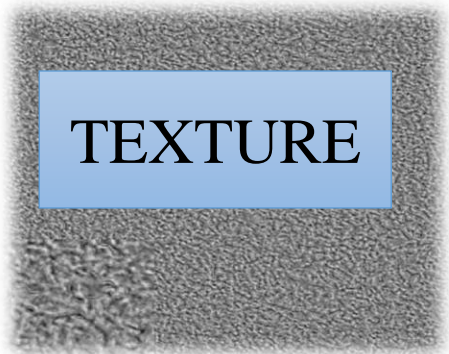STRUCTURE

PSNR = 16.7456

TEXTURE

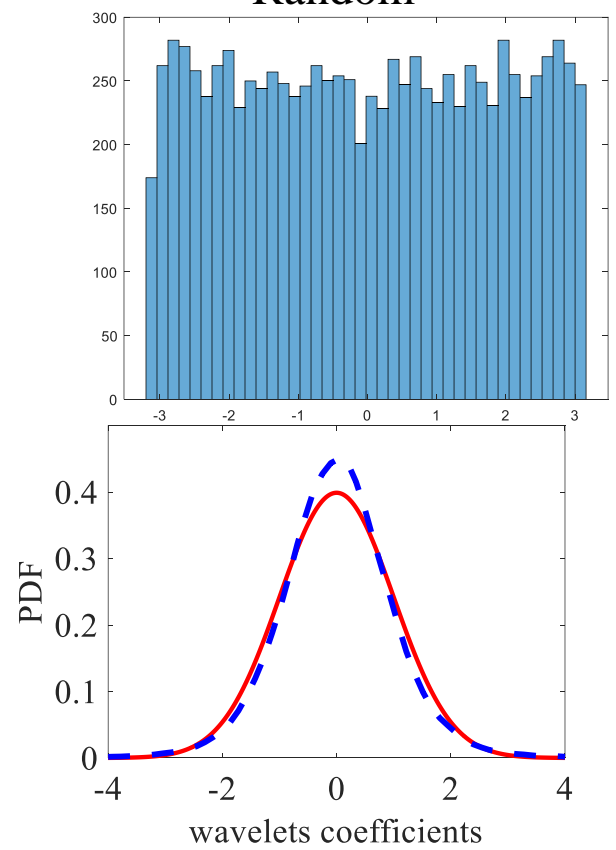PSNR = 30.824

TEXTURE

STRUCTURE

PHASE

MAGNITUDE

Random

Image Dependent
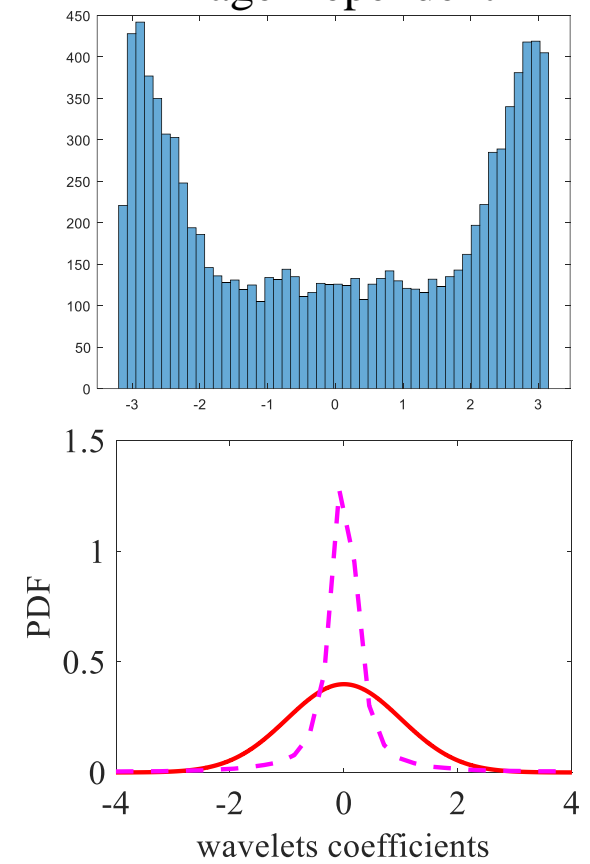
Applications

I. Classification of Textures

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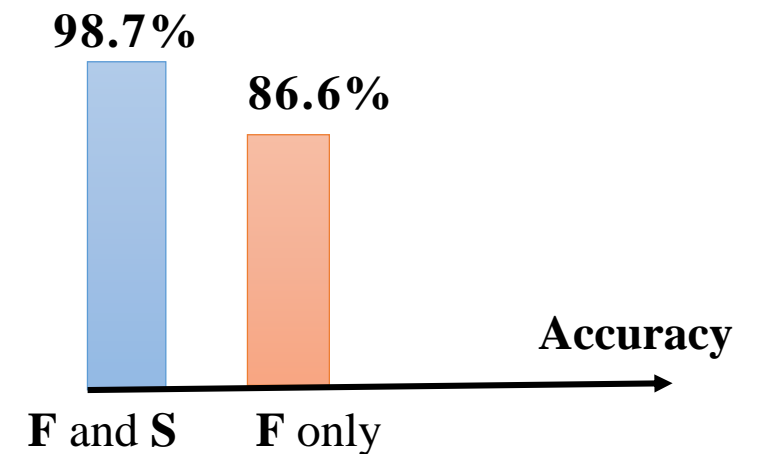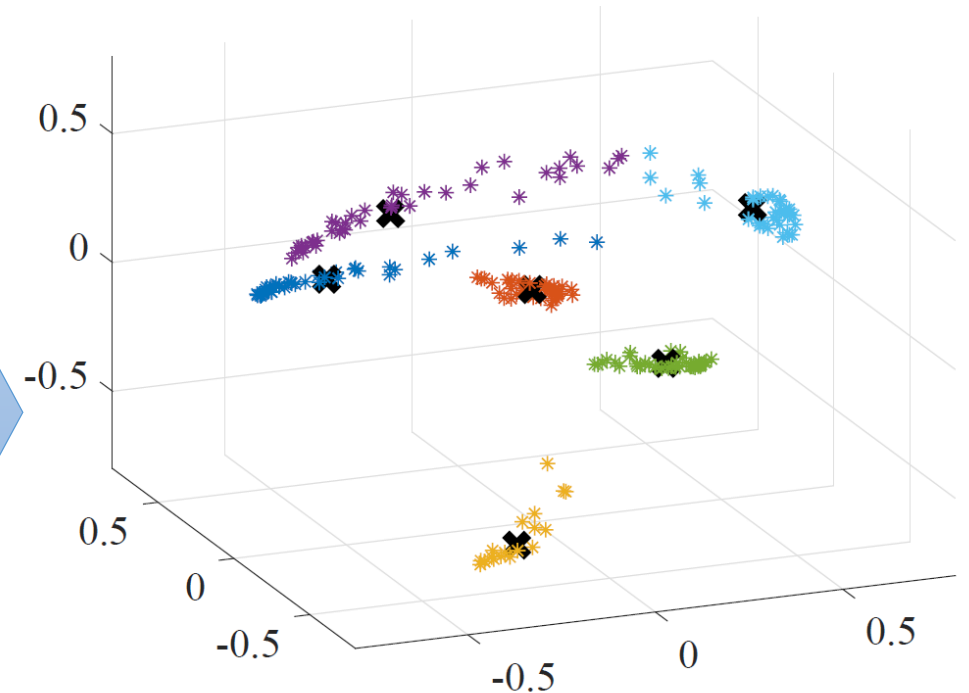
```
Texture-
Structure
Separation
```
→
```
Features
Extraction
```
→
```
Classifier
```

- *Fractal* features (**F**) – Hurst parameter
- *Structured*-related features (**S**) – phase congruency
- Classification via spectral clustering is used
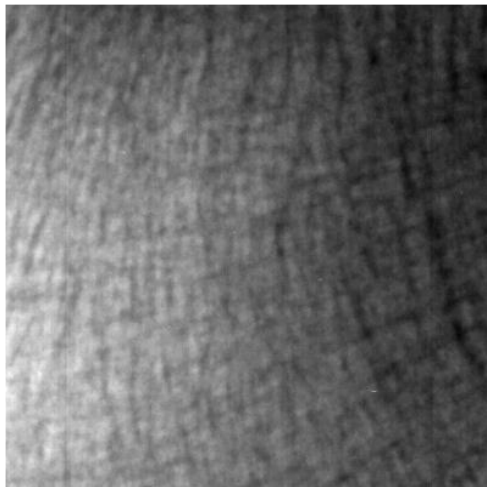
Applications

II. Bone Textures Characterization

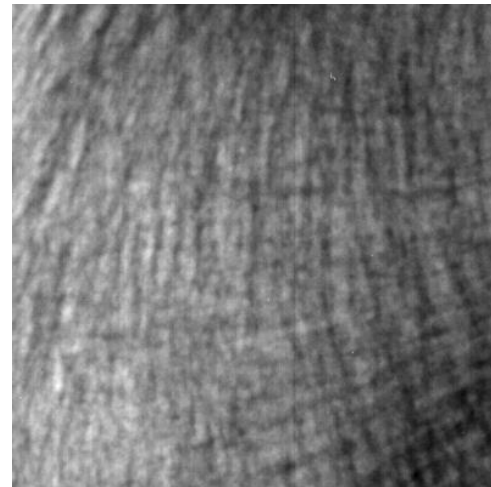# II. Bone Textures Characterization in Radiological Diagnosis

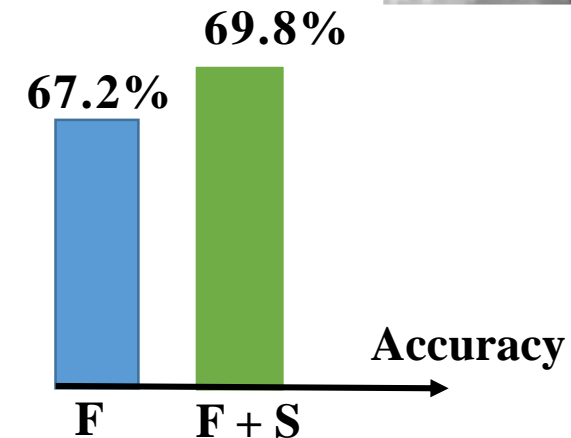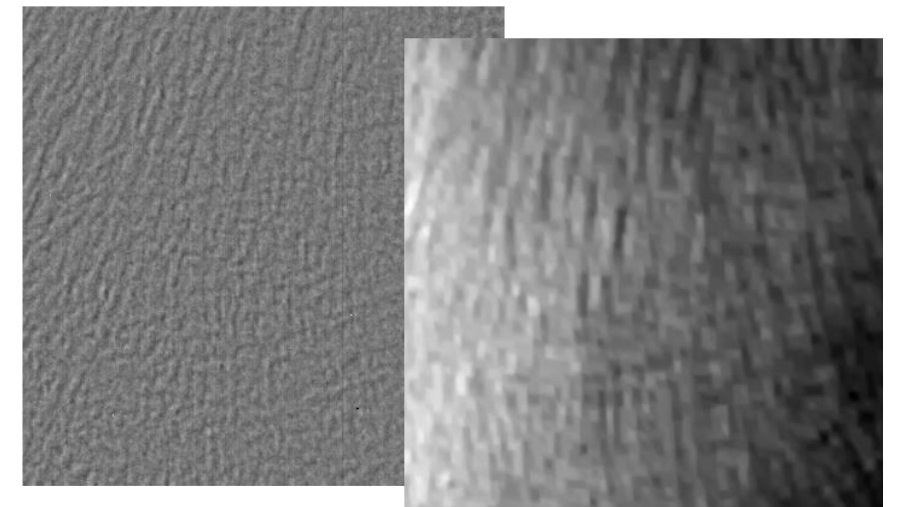| OP #	CT #
58	58

- Goal - **Diagnosis of Osteoporosis**

- High similarity between CT and OP cases

CT

OP

69.8%

67.2%

Accuracy

F   F + S

Thank you