

## Fractal Dimension and Lacunarity of Psoriatic Lesions

### – A Colour Approach –

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## Context

- Skin analysis and characterization
  - Application – measurement of the efficiency of cosmetic and dermatological treatment
- New fractal analysis tools for *colour* images

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## Why Fractal Analysis?

- Fractals are everywhere in nature

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## Fractals and Human Skin

- Skin – fractal pattern (colour and texture)
  - Thin *ditches* that intersect
  - Characteristic *rhomboidal* network
  - Pores and hair of different size, thickness and density

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## Fractal dimension (FD)

- Captures the complexity of a fractal object
- Shows how much space is occupied by the fractal

**1D Random Fractals**

**2D Random Fractals**

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## Lacunarity (Л)

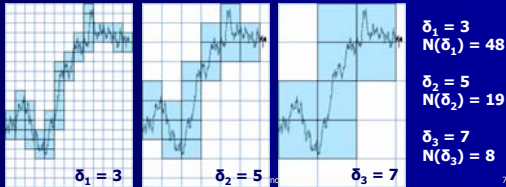
- A mass-distribution function
- Shows how the space is occupied
- Discriminates between objects with the same fractal dimension

Stochastic fractals with the same fractal dimension, but with different lacunarity

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## The Box-Counting FD

- For different box-sizes ( $\delta$ ), count how many boxes ( $N(\delta)$ ) are needed to cover the object
- FD = the slope of the regression line through the points  $\langle \log(\delta), -\log(N(\delta)) \rangle$



## Our Approach

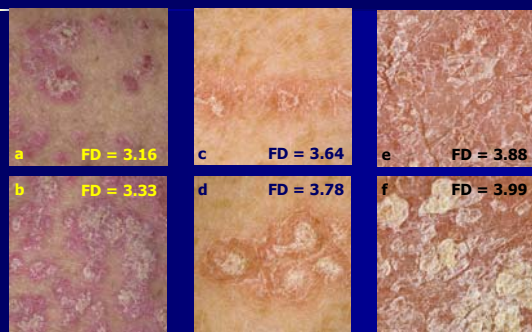
- A colour extension of the Voss probabilistic (box-counting like) approach
- We consider the colour image a 5D object (pixel's spatial coordinates + colour)
- We use hyper-cubes (5D boxes) in the  $(x, y, R, G, B)$  space

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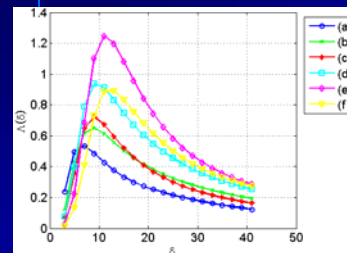
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8

## Experimental Results



## Experimental Results



- (b) more lacunar than (a)
- (d) >>> (c)
- (e) >>> (f) !!!  
Largest zoom factor

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10

## Conclusions

- Fractal dimension and lacunarity
  - appropriate to characterize skin (lesions)
  - capable to reflect the *relative* degree of severity of the psoriatic lesions
- Lacunarity – inversed behaviour (interpretation) for images with the largest zoom factor

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11