Bit Plane

Luca Guarnera, Ph.D.

Research Fellow

luca.guarnera@unict.it

University of Catania
Dipartimento di Economia e Impresa

Types of images - **Black and white**

- **1 bit per pixel**
- At position **(i,j)** there will be either value **0** or value **1**

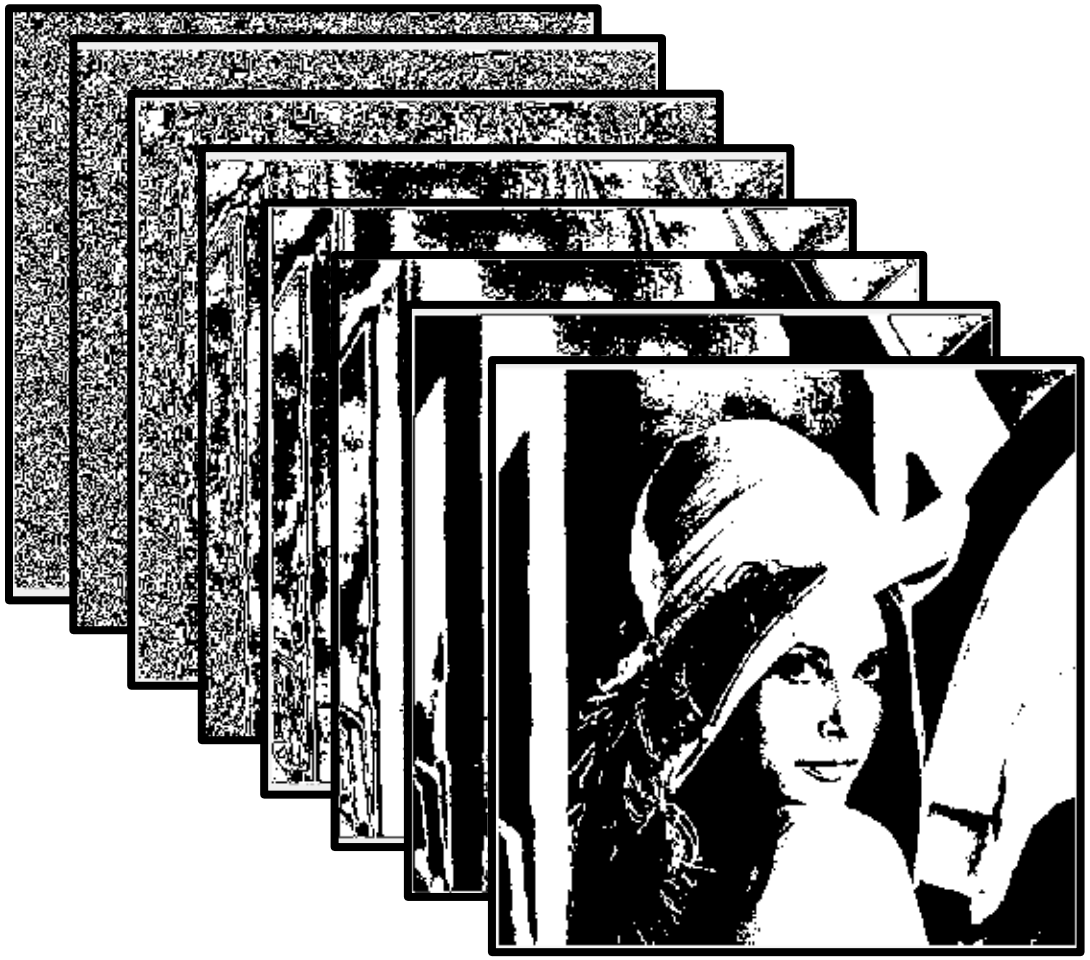
Types of images - Greyscale

- **8 bit per pixel**
- At position **(i,j)** there will be a value between **[0, 255]**

Types of images – Color (e.g. RGB)

- **8 bit per canale**. Since there are 3 channels I will have **24 bit**
- At position **(i,j)** there will be a triplet of the type **(x, y, z)** with x, y, z taking values between **[0, 255]**

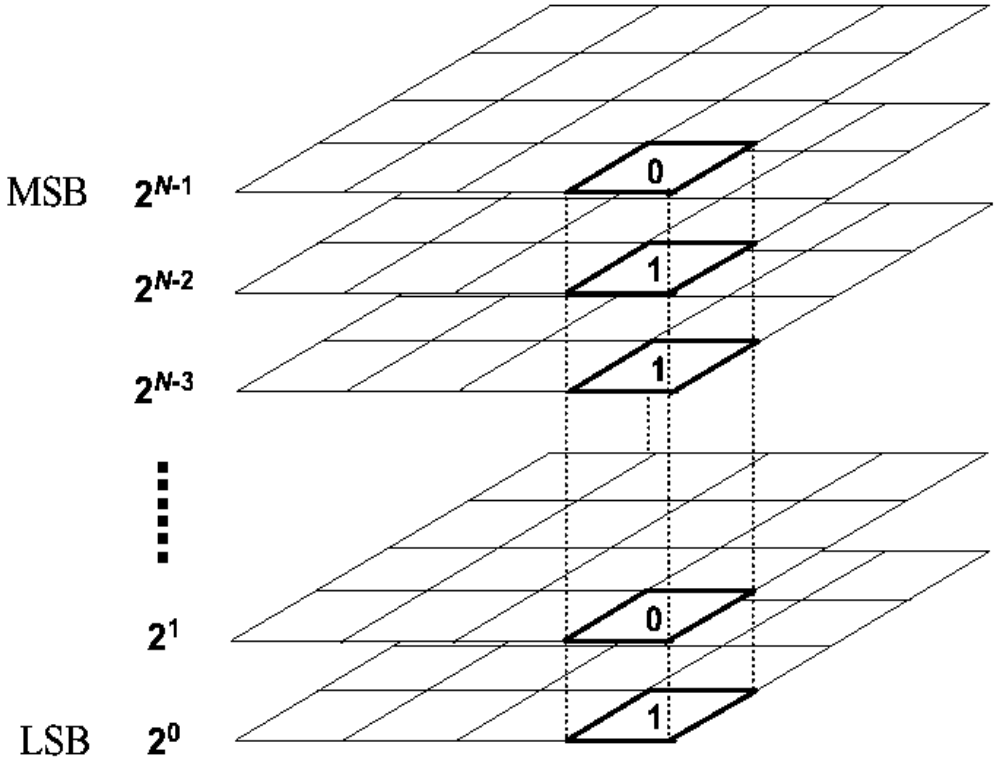
Introduction to Bit Planes



Bit-plane

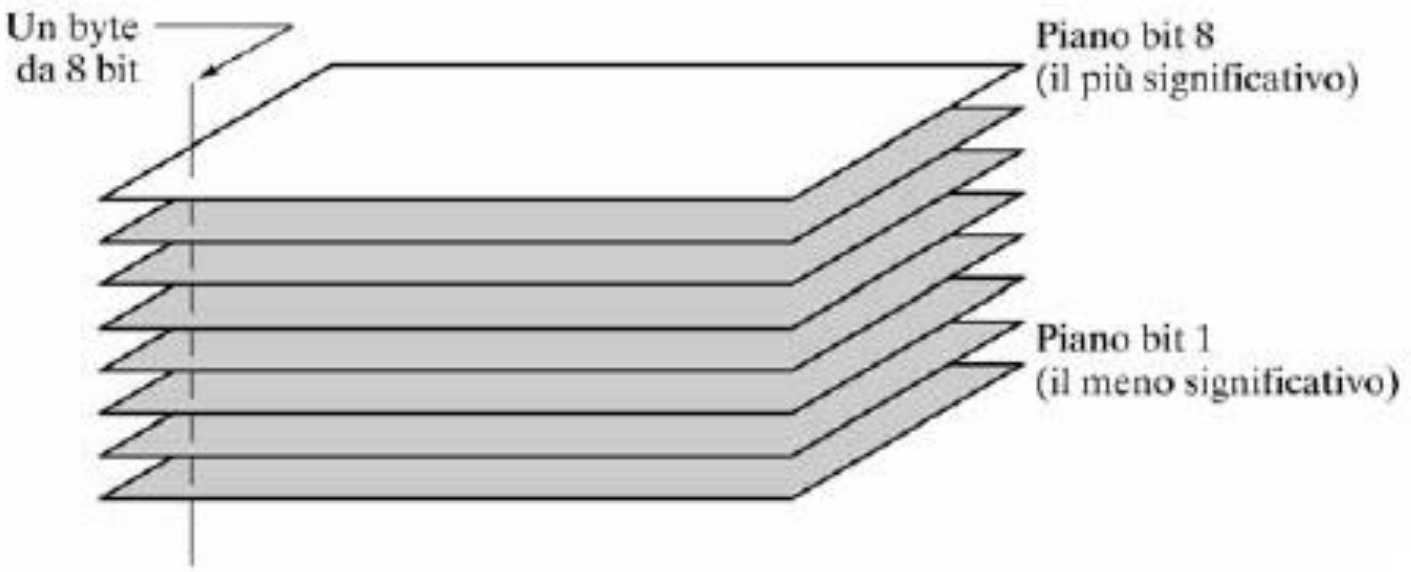
An image with a color depth of N bits can be represented by N bit planes (bit-planes), each of which can be viewed as a single binary image.

In particular, an order ranging from **Most Significant Bit** (MSB) to **Least Significant Bit** (LSB) can be induced.



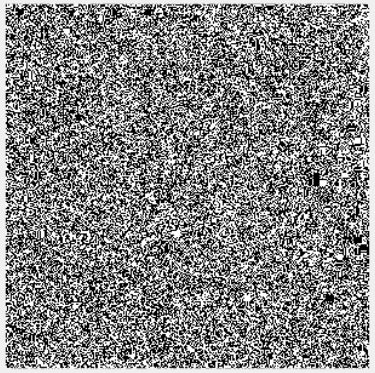
Bit-plane - Definition

The bit plane of an N-bit digital image, is a set of N binary images (planes), in which the i-th image contains the values of the i-th bit of the chosen encoding.

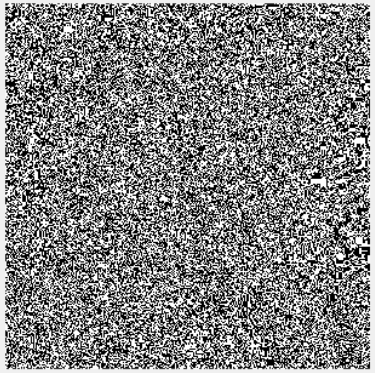


Lena's Bit plane

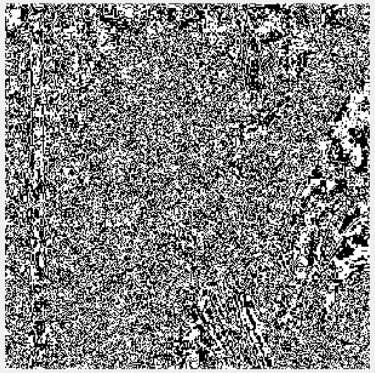
2^0



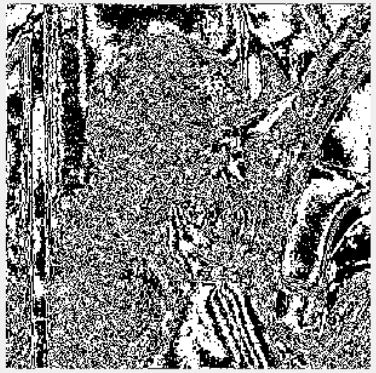
2^1



2^2



2^3



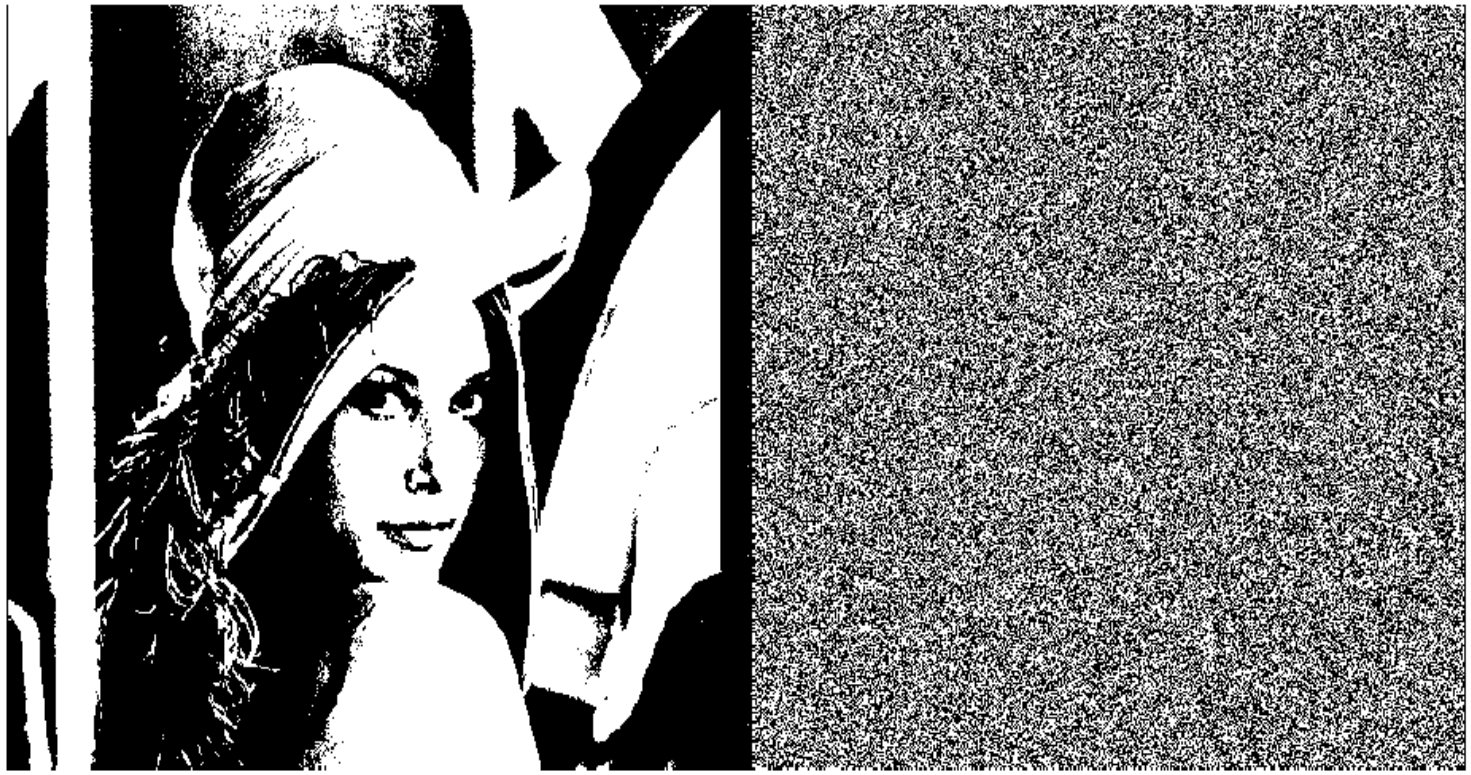
2^4

2^5

2^6

2^7

Bit-planes - binary encoding



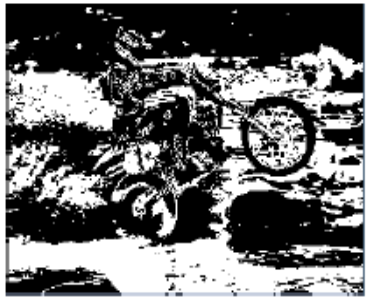
Most Significant bit (**MSB**) Least Significant bit (**LSB**)

Bit-planes: Osservazioni

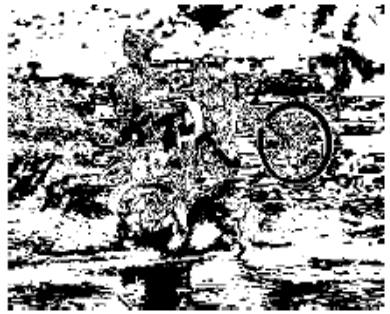
- The more significant bit planes contain information about the structure of the image, while the progressively less significant bit planes provide the increasingly smaller details.
- Note that only planes 7 through 3 contain visually significant data.
- Image noise and acquisition errors are most evident in the lower planes.

Bit-planes

7



6



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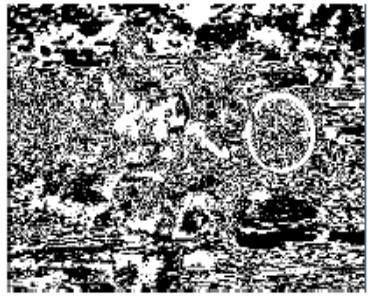

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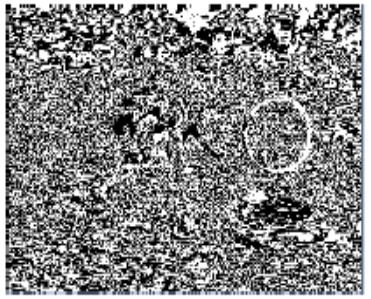

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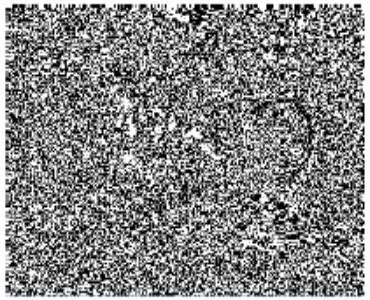

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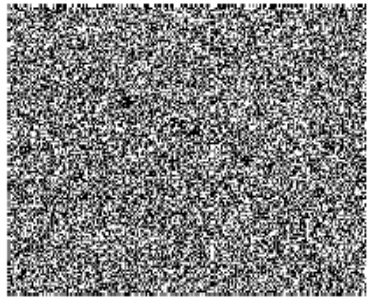
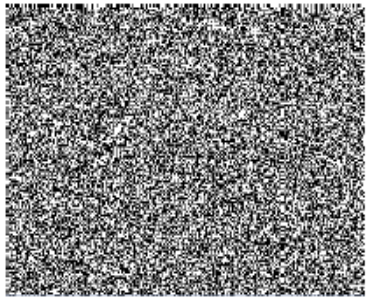


1



0

Bit-plane - Example

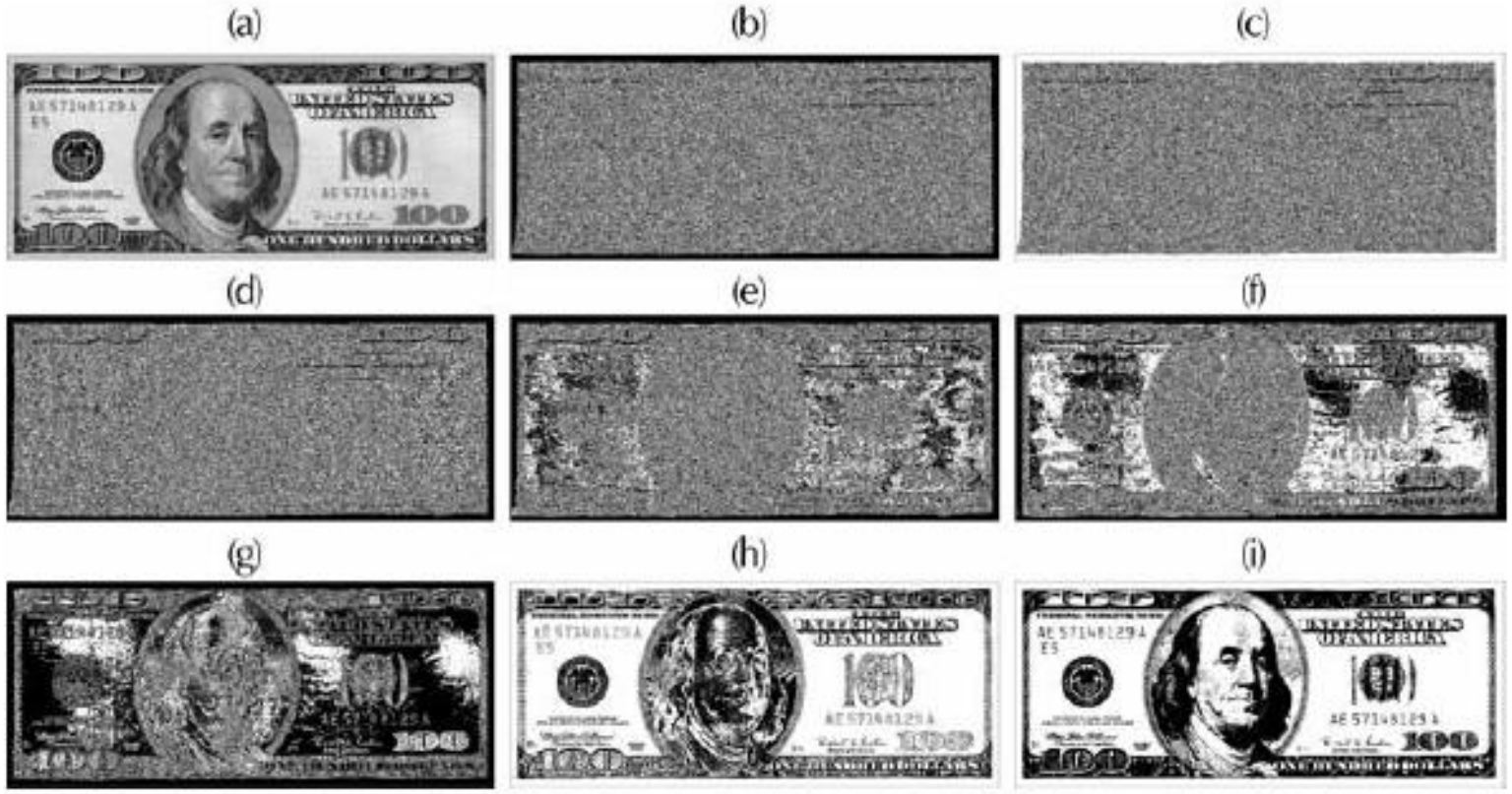


Figura 3.14 (a) Immagine a 8 bit in scala di grigio di 500 × 1192 pixel. Da (b) a (i) i piani di bit da 1 a 8; il piano 1 corrispondente al bit meno significativo. Ogni piano è un'immagine binaria.

Uses of bit-planes

- This kind of decomposition is very useful for removing all values within a certain range.
- For example, if one wants to remove all grays between 32 and 64, it is necessary to set the fifth bit to 0, and thus all of plane 5.

Reconstruction without a bit plan

Bit Plane

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