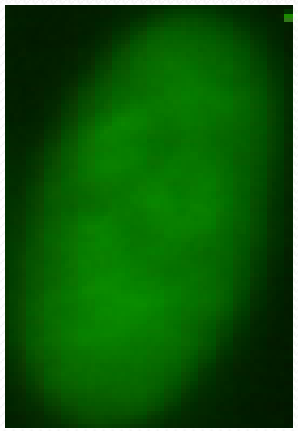


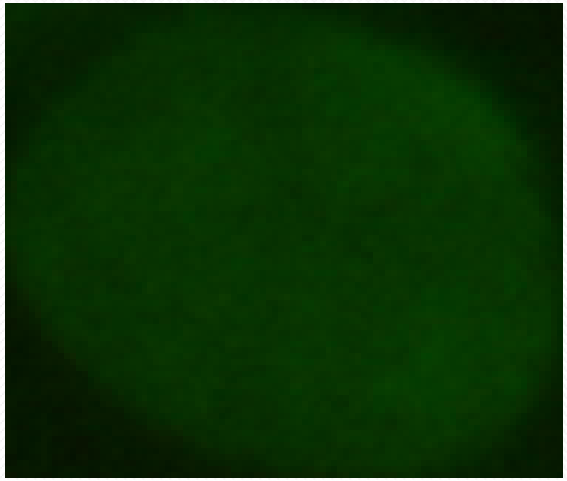

Università degli Studi di Napoli Federico II
Intelligenza Artificiale

Classificazione di cellule

Classi

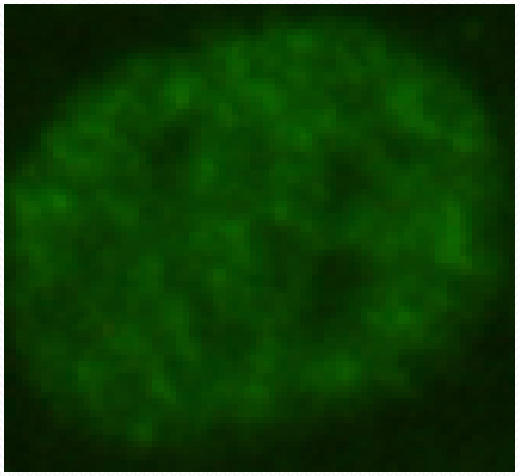
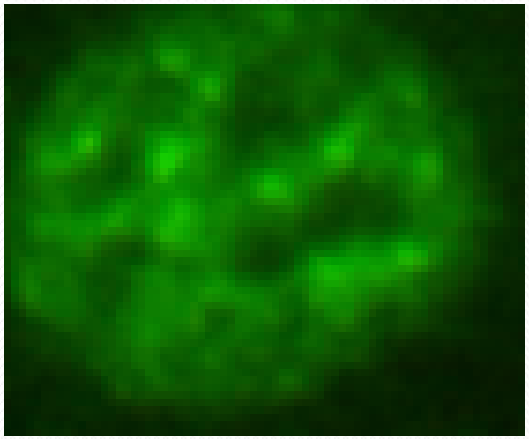
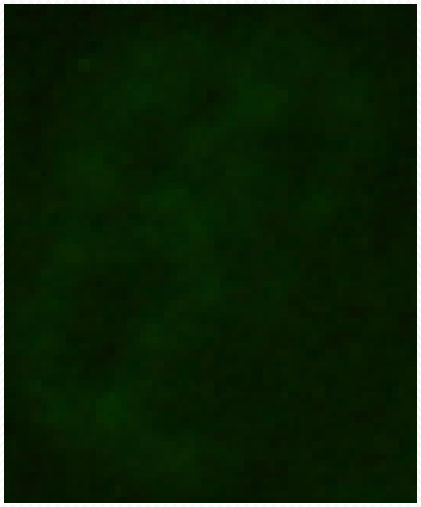
1. Homogeneous:
   A uniform diffuse fluorescence covering the entire nucleoplasm sometimes accentuated in the nuclear periphery.





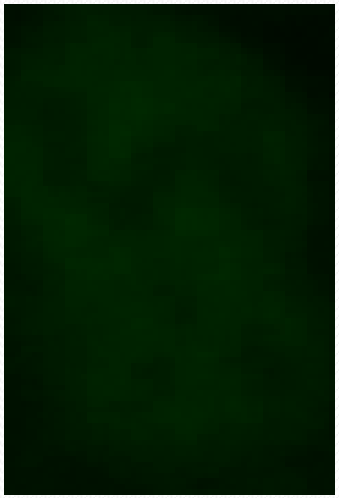
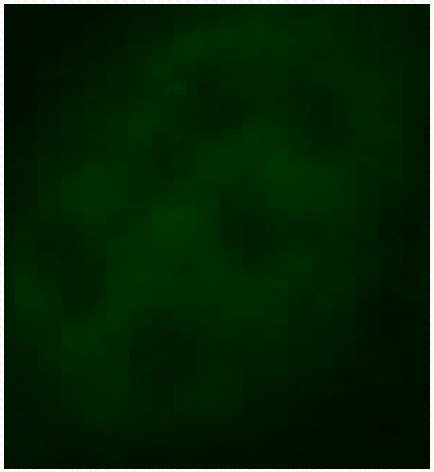
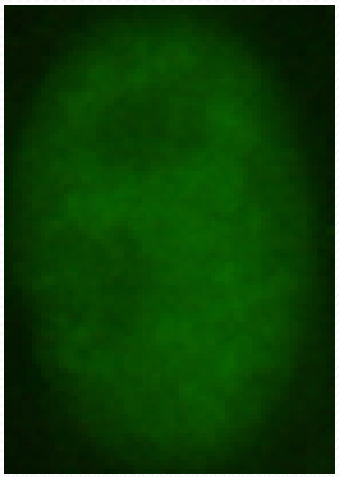
Classi

2. Coarse speckled:
   Densely distributed, variously sized speckles, generally associated with larger speckles, throughout nucleoplasm of interphase cells; nucleoli are negative.

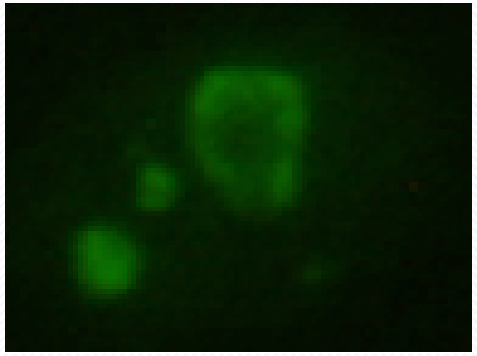
Classi

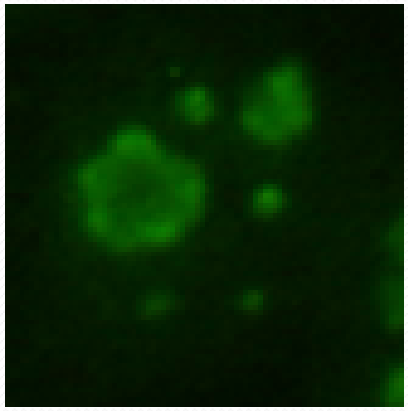
3. Fine speckled:
   Fine speckled staining in a uniform distribution, sometimes very dense so that an almost homogeneous pattern is attained; nucleoli may be positive or negative.

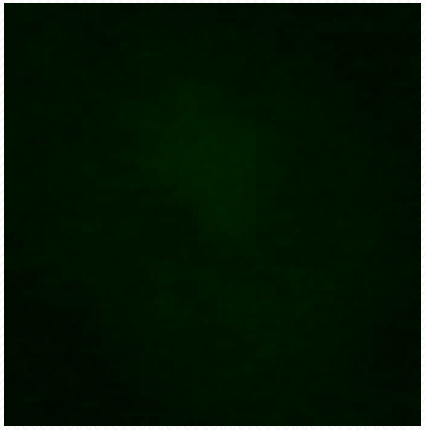




Classi

4. Nucleolar:
   Brightly clustered large granules corresponding to decoration of the fibrillar centers of the nucleoli as well as the coiled bodies.

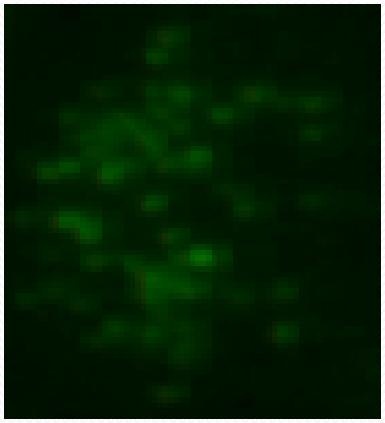


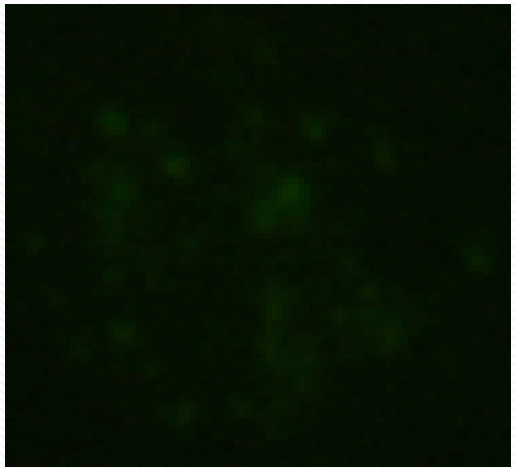


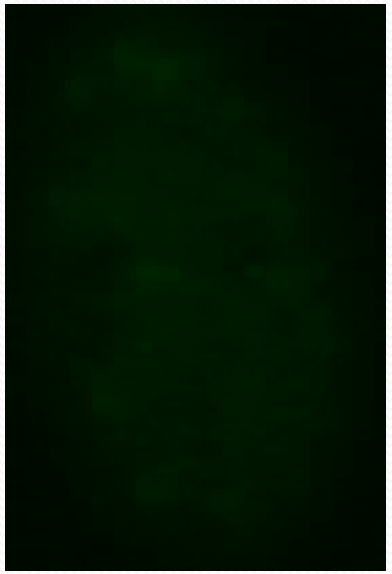


Classi

5. Centromere:
   Rather uniform discrete speckles located throughout the entire nucleus.

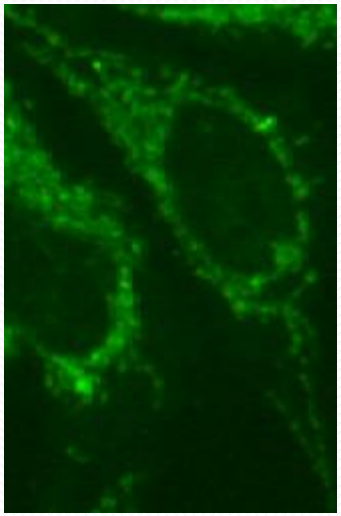


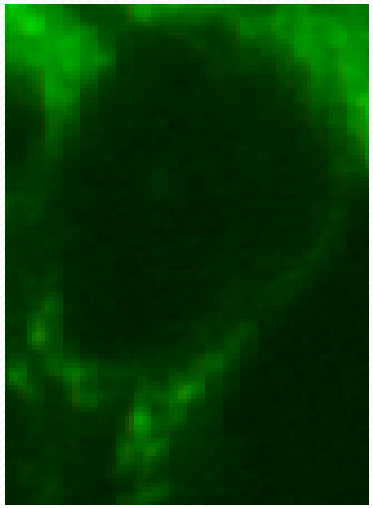


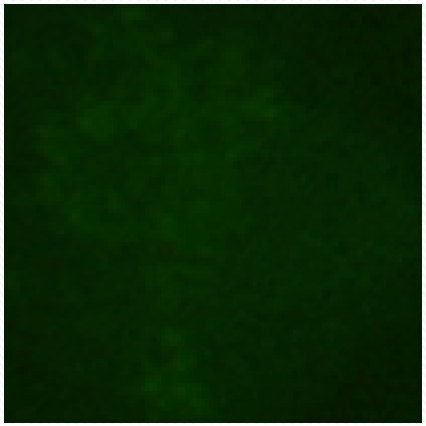


Classi

6. Cytoplasmatic:
   It is relevant to diagnostic purposes since it can be associated with specific and heterogeneous autoantibodies.

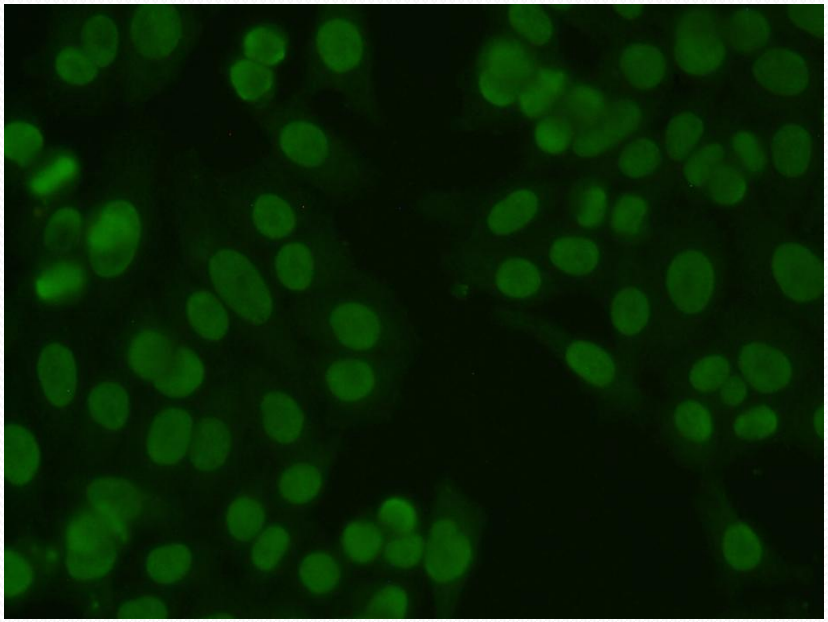


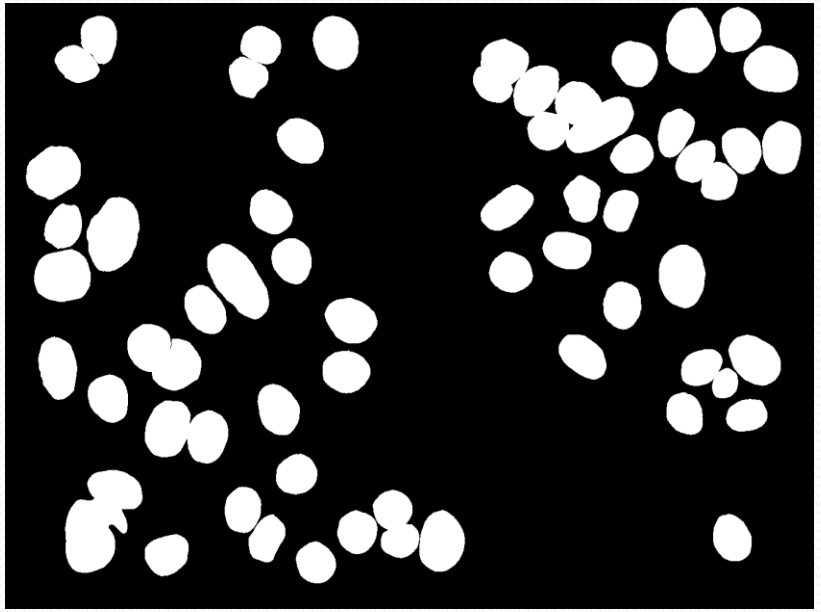




Soggetti

- Le cellule sono segmentate a mano a partire da acquisizioni per ogni soggetto
- Cellule provenienti dallo stesso soggetto risultano correlate



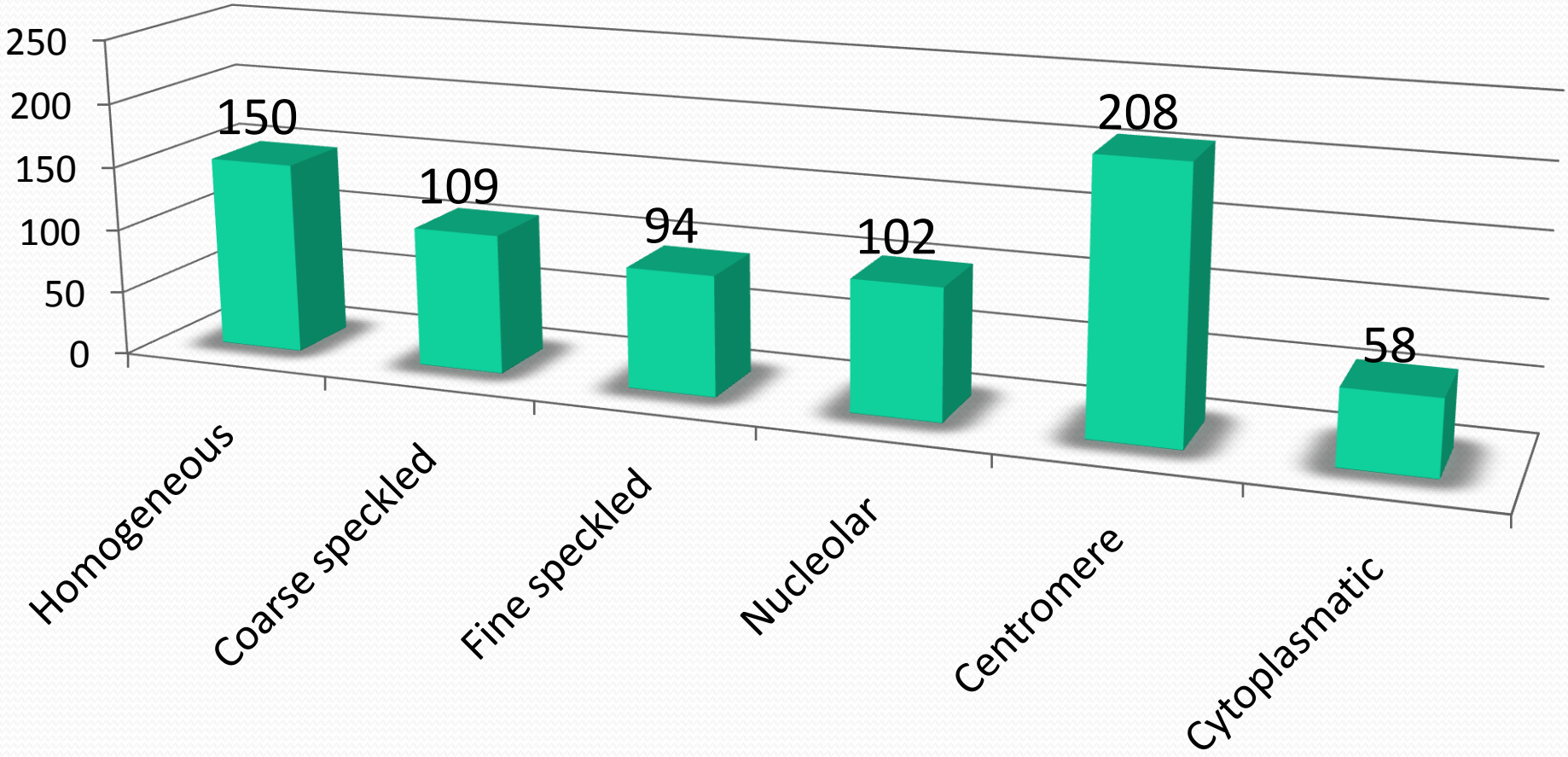


Soggetti

- Le cellule sono segmentate a mano a partire da acquisizioni per ogni soggetto
- Cellule provenienti dallo stesso soggetto risultano correlate

- **14 soggetti** nel training set ed **altri 14 soggetti** nel test set

Distribuzione dei campioni



Features

- Sfruttare l'informazione contenuta nelle relazioni tra pixel vicini dell'immagine
- Ricerca di pattern locali delle immagini tramite opportuni filtri
- Calcolo l'istogramma che cattura anche i pattern minori

Features: esempio

Local Binary Pattern

$$\begin{bmatrix} x_0 & x_1 & x_2 \\ x_7 & x & x_3 \\ x_6 & x_5 & x_4 \end{bmatrix}$$

$$\sum_{i=0}^{7} s(x_i - x)2^i, \qquad s(x) = \begin{cases} 1 \; x \geq 0 \\ 0 \; x < 0 \end{cases}$$

- Calcolato su finestre circolari

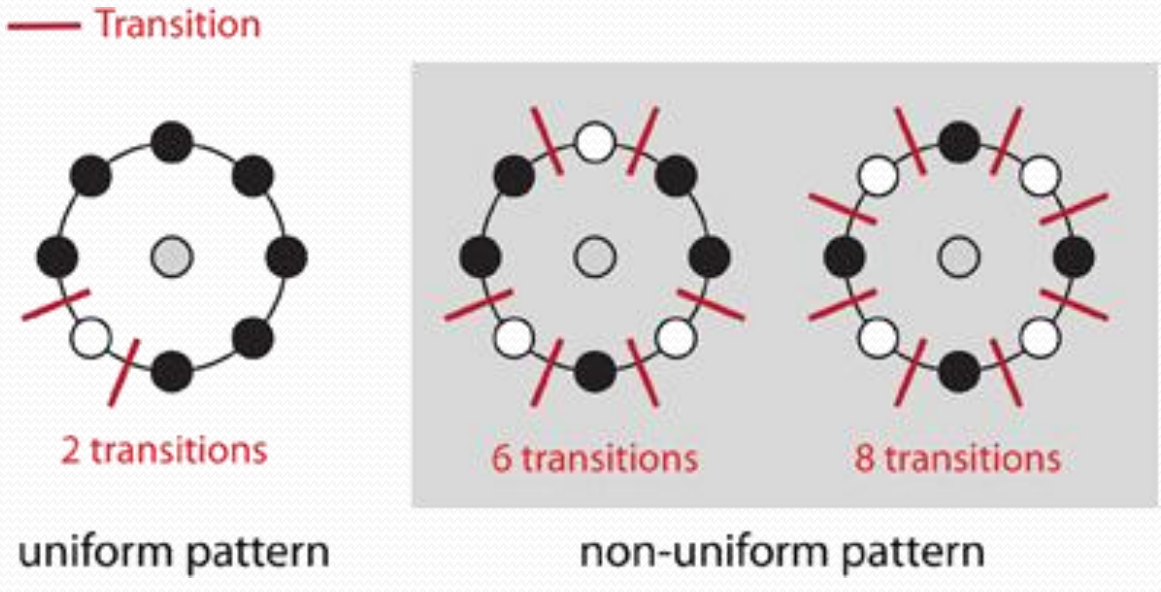
Features: esempio

Local Binary Pattern

$$\begin{bmatrix} x_0 & x_1 & x_2 \\ x_7 & x & x_3 \\ x_6 & x_5 & x_4 \end{bmatrix}$$

$$\sum_{i=0}^{7} s(x_i - x)2^i, \qquad s(x) = \begin{cases} 1 \; x \geq 0 \\ 0 \; x < 0 \end{cases}$$

- Calcolato su finestre circolari



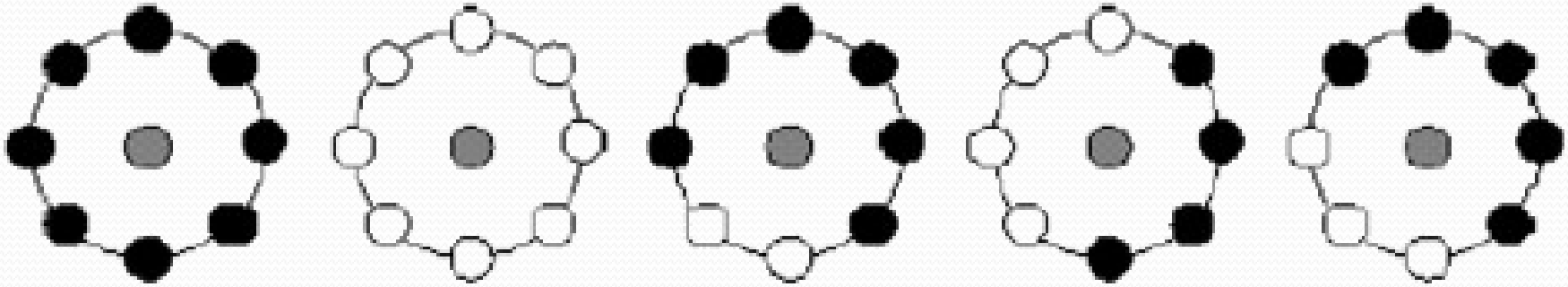
Features: esempio

Local Binary Pattern

$$\begin{bmatrix} x_0 & x_1 & x_2 \\ x_7 & x & x_3 \\ x_6 & x_5 & x_4 \end{bmatrix}$$

$$\sum_{i=0}^{7} s(x_i - x)2^i, \qquad s(x) = \begin{cases} 1 \; x \geq 0 \\ 0 \; x < 0 \end{cases}$$

- Calcolato su finestre circolari



Features: esempio

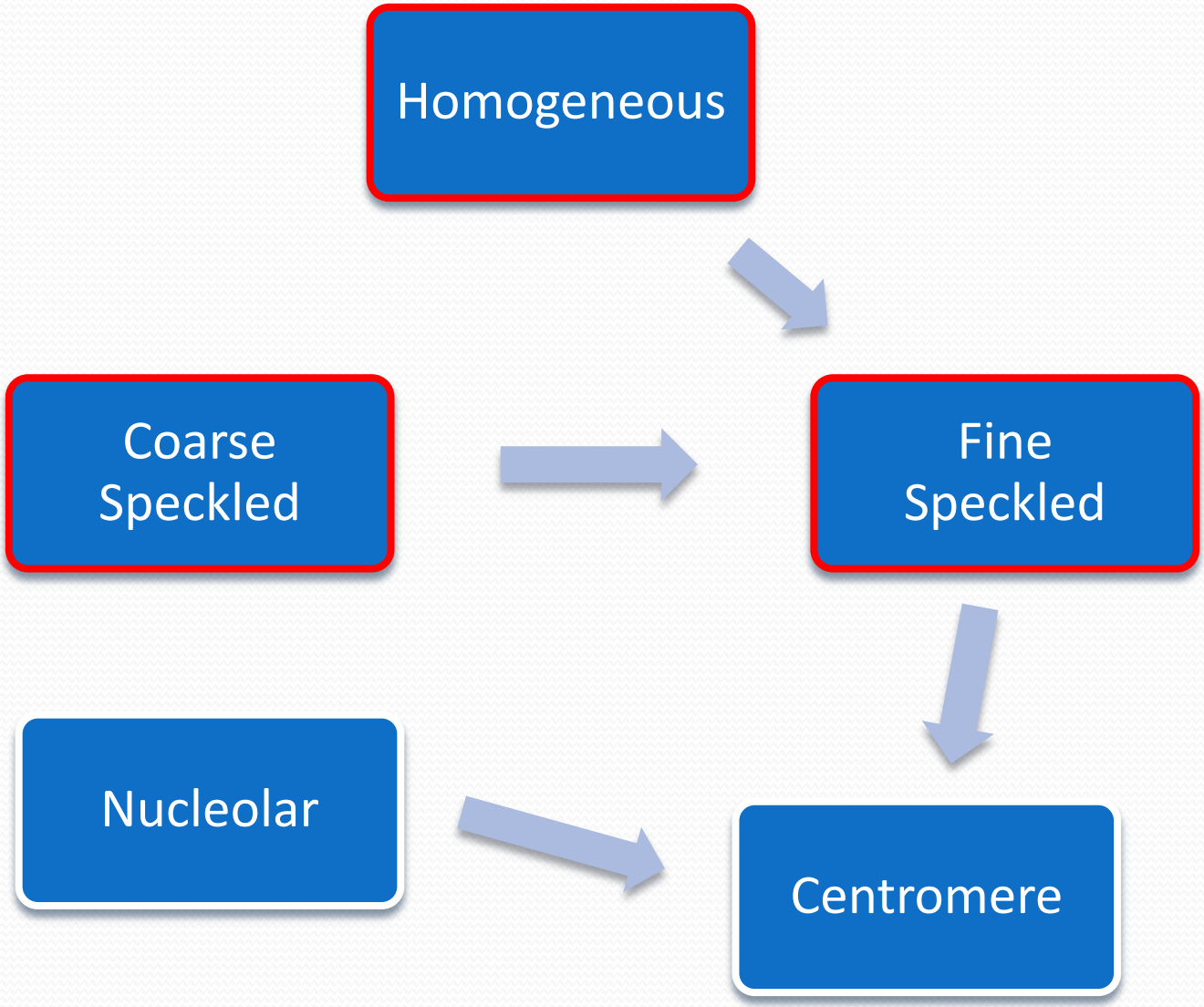
Local Binary Pattern

$$\begin{bmatrix} x_0 & x_1 & x_2 \\ x_7 & x & x_3 \\ x_6 & x_5 & x_4 \end{bmatrix}$$

$$\sum_{i=0}^{7} s(x_i - x)2^i, \qquad s(x) = \begin{cases} 1 \; x \geq 0 \\ 0 \; x < 0 \end{cases}$$

- Calcolato su finestre circolari
- Aggrega pattern non-uniformi (3 o più transizioni 0/1 o 1/0)
- Rotation invariant: aggrega pattern ruotati

Confusione


Homogeneous
Coarse Speckled
Fine Speckled
Nucleolar
Centromere

Metrica

Il classificatore deve esibire performance equilibrate tra le varie classi

- Lo score è di norma calcolato come media dell'accuracy sulle singole classi
- **Gli errori sulle classi meno rappresentate devono pesare maggiormente sullo score finale**
- **Verranno considerati costi diversi a seconda del tipo di errore commesso**