

Edge-end Pixel Extraction for Edge-based Image Segmentation

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Cuprins

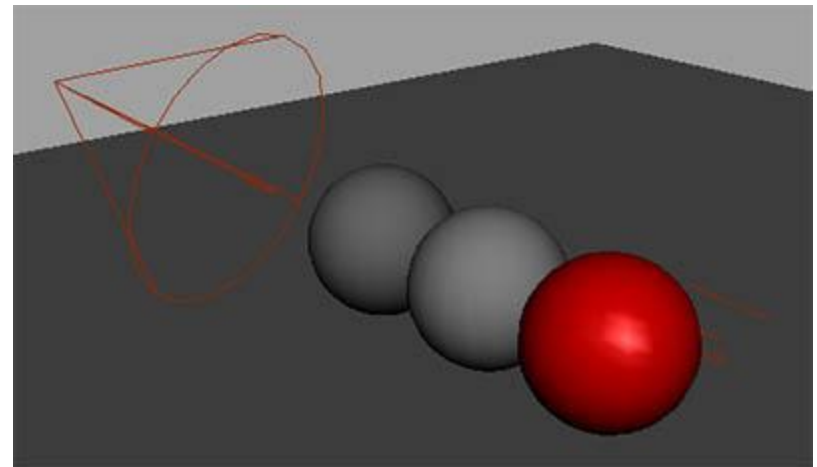
1. Image segmentation
2. Edge detection
 - Sobel
 - Laplace
3. Edge-end Pixel Extraction for Edge-based Image Segmentation
4. Concluzii
5. Bibliografie

Image segmentation

- **Localizarea liniilor, curbelor in imagini**
- **Gruparea pixelilor cu caracteristici vizuale asemanatoare**
- **Rezultat:**
 - Set de segmente ale imaginii
 - Set de contururi (edge detection)
 - Pixelii dintr-o regiune au o proprietate comuna:
 - Culoare, intensitate, textura
 - Pixelii din regiuni adiacente sunt foarte diferiti
- **Marginile regiunilor si marginile imaginilor sunt asemanatoare**

Probleme - Edge detection

- **Blur cauzat de focalizarea aparatului**
- **Blur cauzat de iluminare cu surse nepunctiforme**
- **Iluminarea suprafetelor netede**



Metode - Edge detection

- **Pixelii vecini sunt foarte diferiti in intensitate**
- **2 tipuri de metode:**
 - **aproximarea gradientului - Sobel**
 - **aproximarea $f''(t)$ a gradientului - Laplace**



Sobel

| | | |
|----|---|----|
| -1 | 0 | +1 |
| -2 | 0 | +2 |
| -1 | 0 | +1 |

Gx

| | | |
|----|----|----|
| +1 | +2 | +1 |
| 0 | 0 | 0 |
| -1 | -2 | -1 |

Gy

- **Determinarea gradientului**
 - estimarea gradientului spatial al unei imagini gri in fiecare punct, folosind masti de convolutie
 - Un pixel e edge-pixel daca valoarea b_{ij} depaseste un anumit threshold

Input Image

| | | | | |
|----------|----------|----------|-----|----------|
| a_{11} | a_{12} | a_{13} | ... | a_{1n} |
| a_{21} | a_{22} | a_{23} | ... | a_{2n} |
| a_{31} | a_{32} | a_{33} | ... | a_{3n} |
| ⋮ | ⋮ | ⋮ | | ⋮ |
| | | | | |

Mask

| | | |
|----------|----------|----------|
| m_{11} | m_{12} | m_{13} |
| m_{21} | m_{22} | m_{23} |
| m_{31} | m_{32} | m_{33} |

Output Image

| | | | | |
|----------|----------|----------|-----|----------|
| b_{11} | b_{12} | b_{13} | ... | b_{1n} |
| b_{21} | b_{22} | b_{23} | ... | b_{2n} |
| b_{31} | b_{32} | b_{33} | ... | b_{3n} |
| ⋮ | ⋮ | ⋮ | | ⋮ |
| | | | | |

$$b_{22} = (a_{11} * m_{11}) + (a_{12} * m_{12}) + (a_{13} * m_{13}) + (a_{21} * m_{21}) + (a_{22} * m_{22}) + (a_{23} * m_{23}) + (a_{31} * m_{31}) + (a_{32} * m_{32}) + (a_{33} * m_{33})$$

Laplace

- La fel ca Sobel, doar ca foloseste o singura masca de convolutie 5x5
- Masca estimeaza cea de-a doua derivata a gradientului

| | | | | |
|----|----|----|----|----|
| -1 | -1 | -1 | -1 | -1 |
| -1 | -1 | -1 | -1 | -1 |
| -1 | -1 | 24 | -1 | -1 |
| -1 | -1 | -1 | -1 | -1 |
| -1 | -1 | -1 | -1 | -1 |

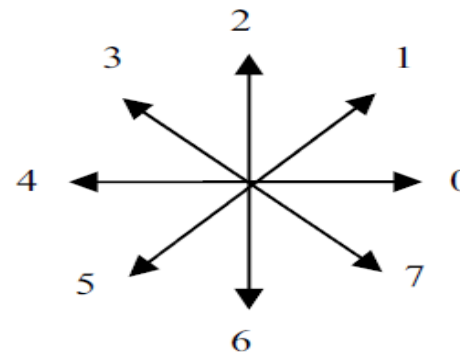
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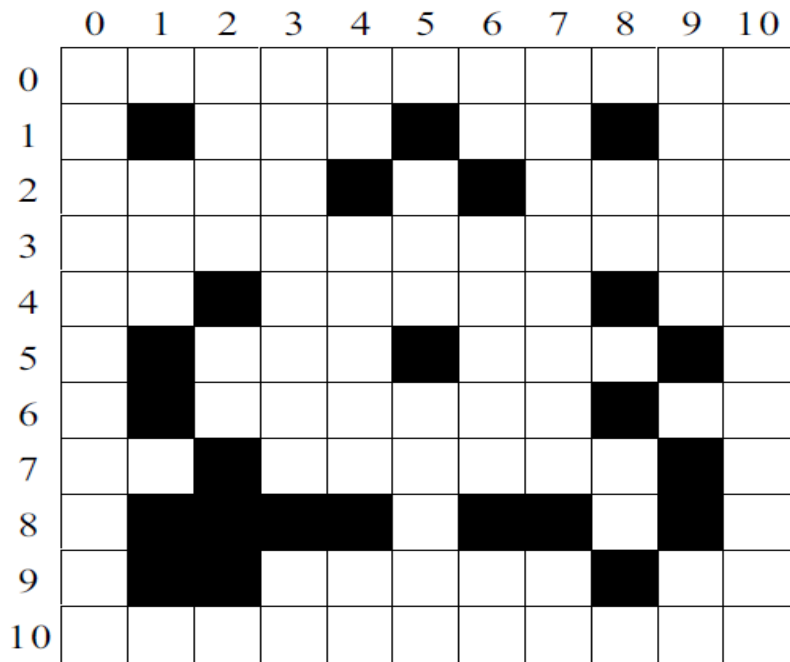
Extragerea pixelilor edge-end

- **Scop: extractia edge-pixelilor**
 - **dupa un threshold**
 - **rezultatele sunt inexacte daca exista granite intrerupte intre zone**
- **Solutie: masuri pentru prevenirea edge-urilor intrerupte**
 - **Directia gradientului**
 - **Retelele neurale favorizeaza directia in care exista edge-pixeli succesivi la detectarea edge-urilor**

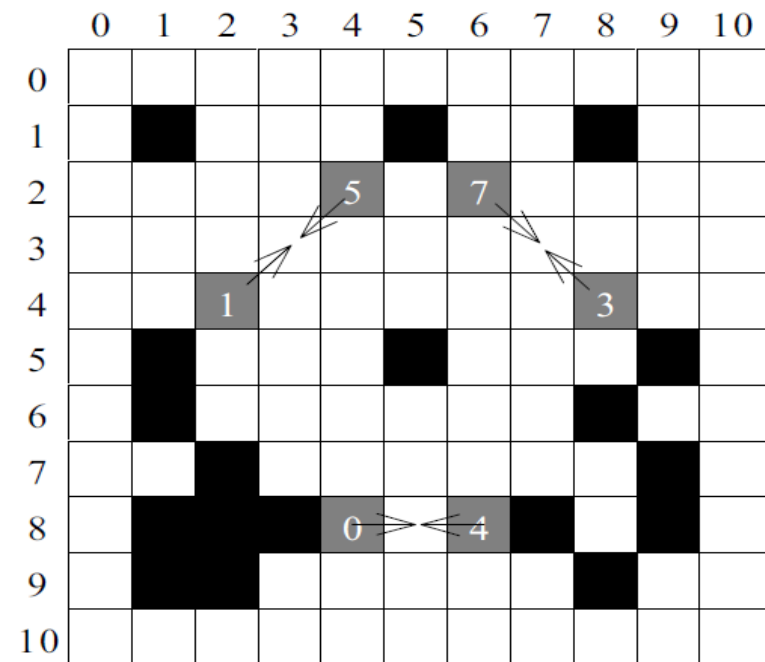


Extragerea pixelilor edge-end

- **grid Pix[rows][cols] - x, y, filled, directie**



Input image used in the algorithm: Image pixels (black) and empty pixels (white) in 11x11 grid



Composite image comprising extracted edge-end pixels, input image and directional sensitivities

Extragerea pixelilor edge-end

- *For every $p(i,j)$ in grid*
 - *If $(p(i,j) == \text{filled})$*
 - *For vecin = 0 to 8*
 - *If $\text{filled}(\text{vecin})$ nr_filled++;*
 - *If nr_filled == 1*
 - *Direction = directia opusa vecinului(0,180)*
 - *set(pixArray[i][j],dir); // edge pixel*
- *Elimina pixelii fara vecini considerandu-i noise*

Concluzii

- **Extragerea pixelilor edge-end si a directiilor asociate**
 - **Retele neurale: edge-linking**
 - **Modelarea sistemelor fizice si biologice (neuroni)**
 - **Imagini medicale - detectia discontinuitatilor la nivel celular**

Bibliografie

- <http://en.wikipedia.org/>
- **Edge-end Pixel Extraction for Edge-based Image Segmentation, Mahinda P. Pathegama and Özdemir Göl**
- <http://www.pages.drexel.edu/~weg22/edge.html>
- <http://www.3dtutorialzone.com/tutorial?id=84>