Lecture 04 - Component Segmentation

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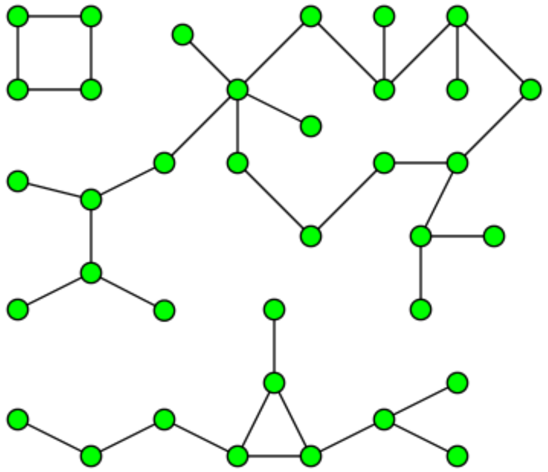
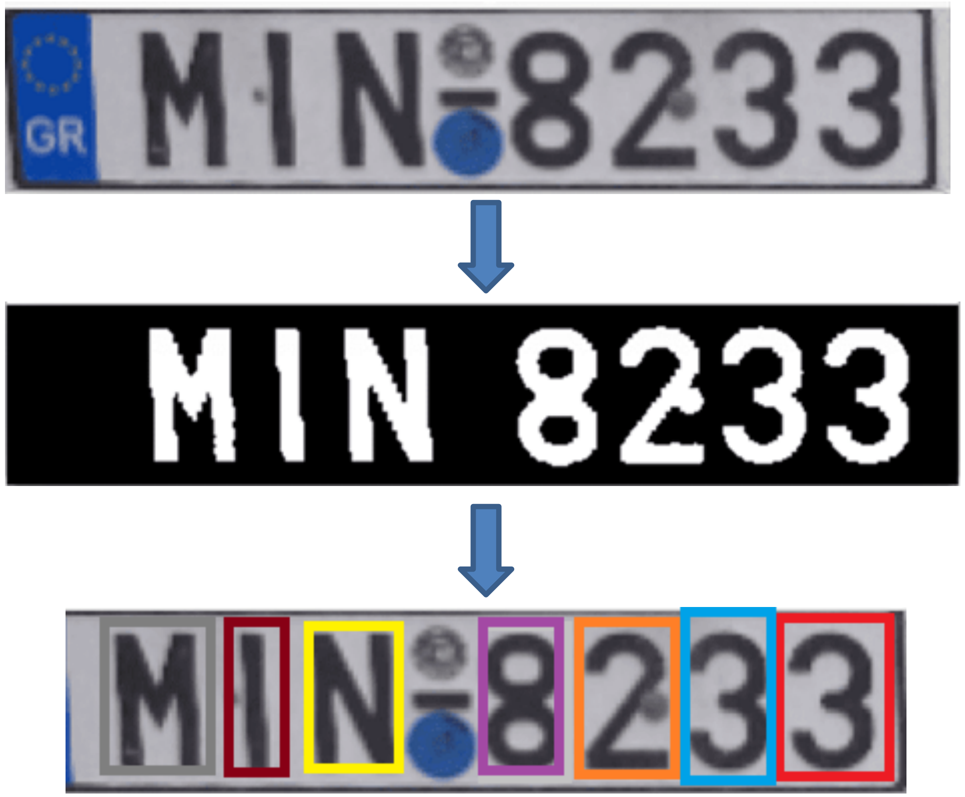
Topics

- Discussion of Practice 03
- Component Segmentation
    - Finding Connected Components
    - Filtering Components
- Practice
    - License Plate Characters Segmentation

Component Segmentation

- A.K.A Connected Component Extraction, Blob Extraction, …..
- Its application comes from Graph Theory
  - Social Networks
  - Biology
  - Pattern Recognition

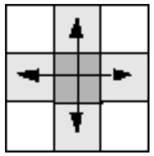




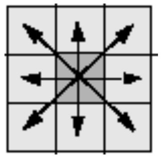
Connected Component Labelling

- Analyzes the non-zero pixel's neighborhood (foreground)
- Label each connected pixel with a label (1,2,3,4....)

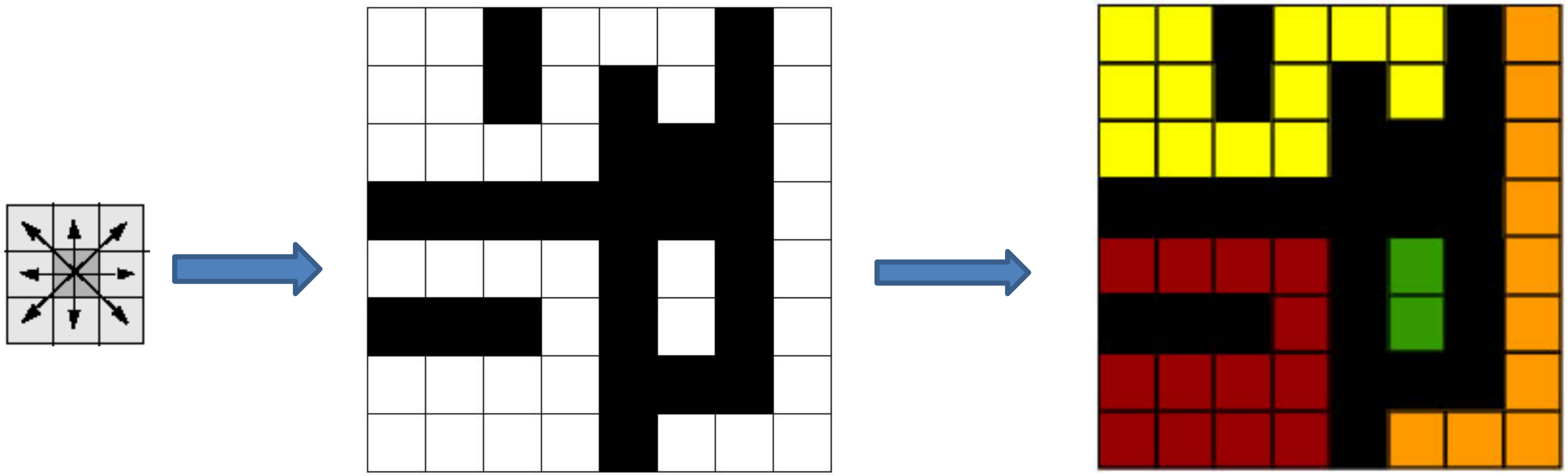
- Kernels:



4-Neighboors



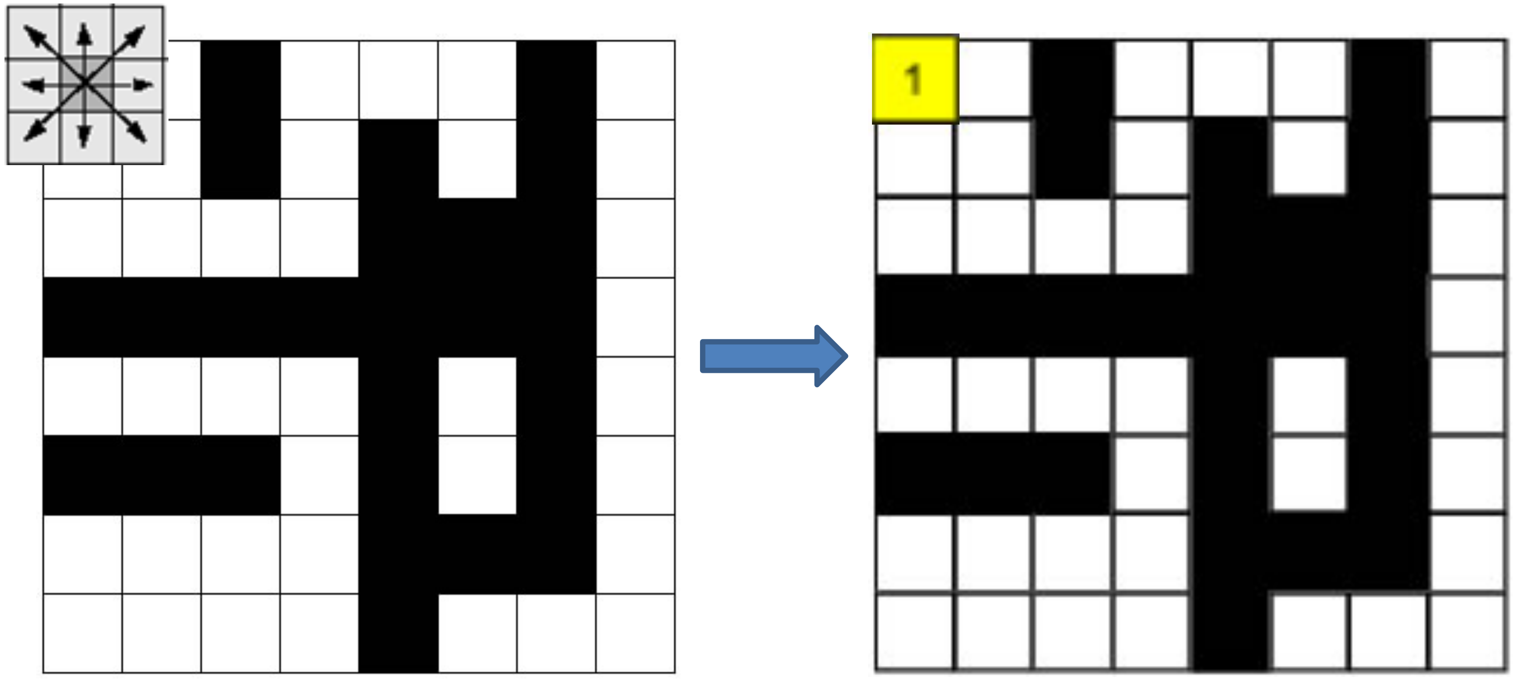
8-Neighboors



Row by Row Algorithm

- Sliding a connectivity kernel , row by row (2 passes)
  - If the center falls in a non-zero pixel, label it!
  - Labeling:
    - If there are no labeled pixels connected, attribute a new label
    - Otherwise, attribute to it the neighbor´s label.
    - A Union-Find structure control adjacent labels (Union-Find)

- **Pass #1:**
  - **Row #1**



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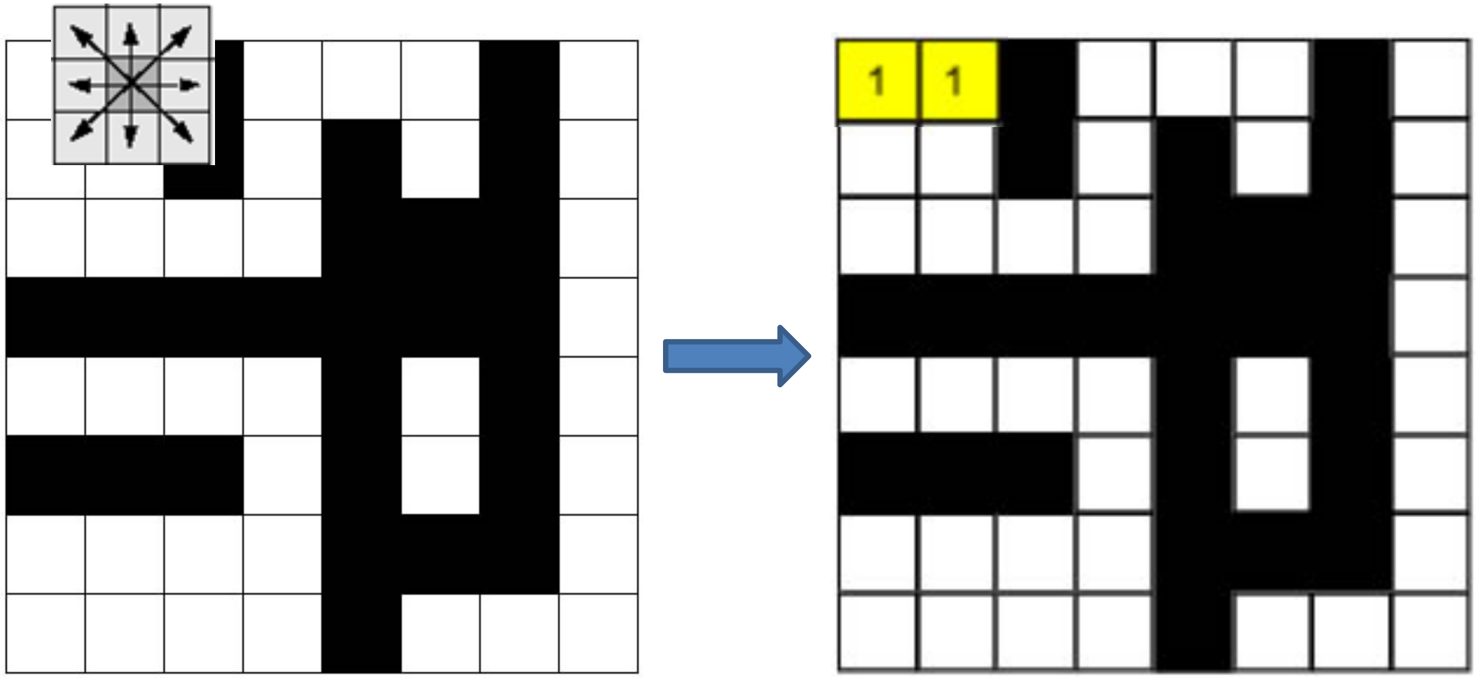

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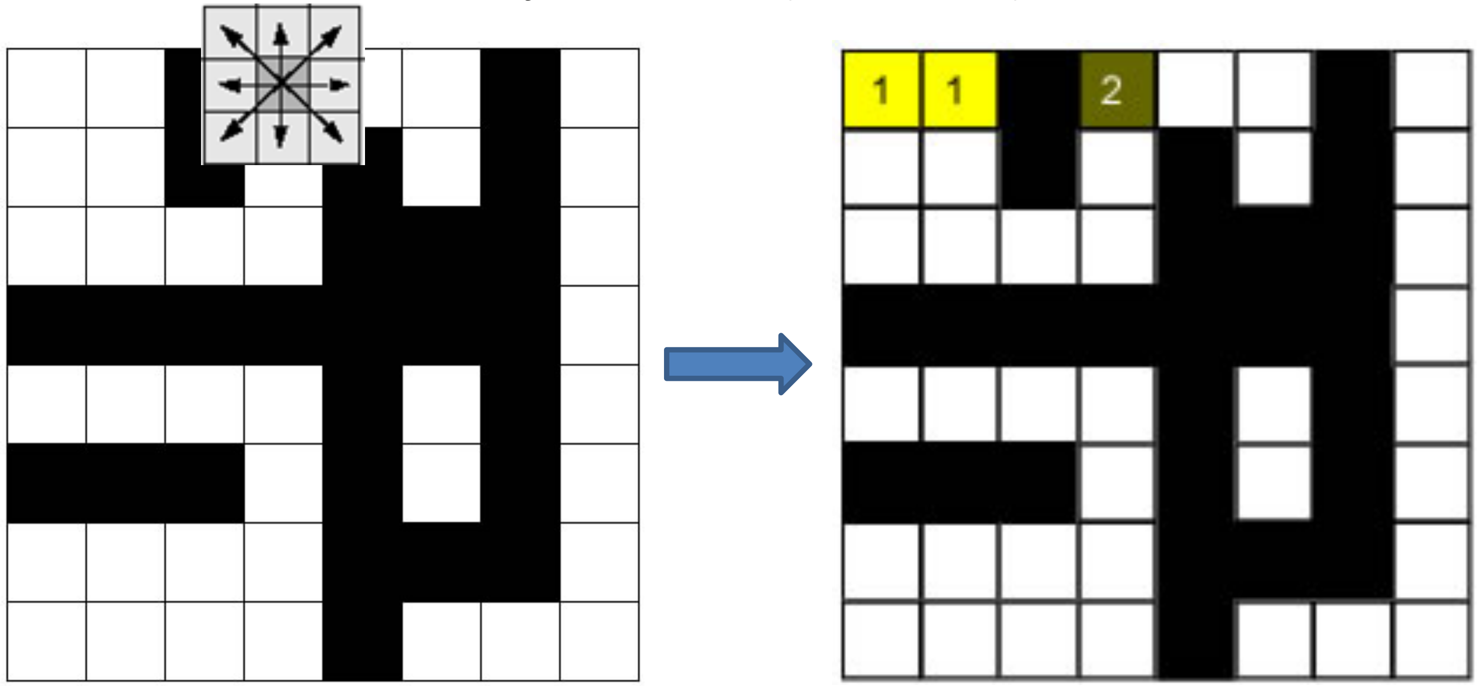

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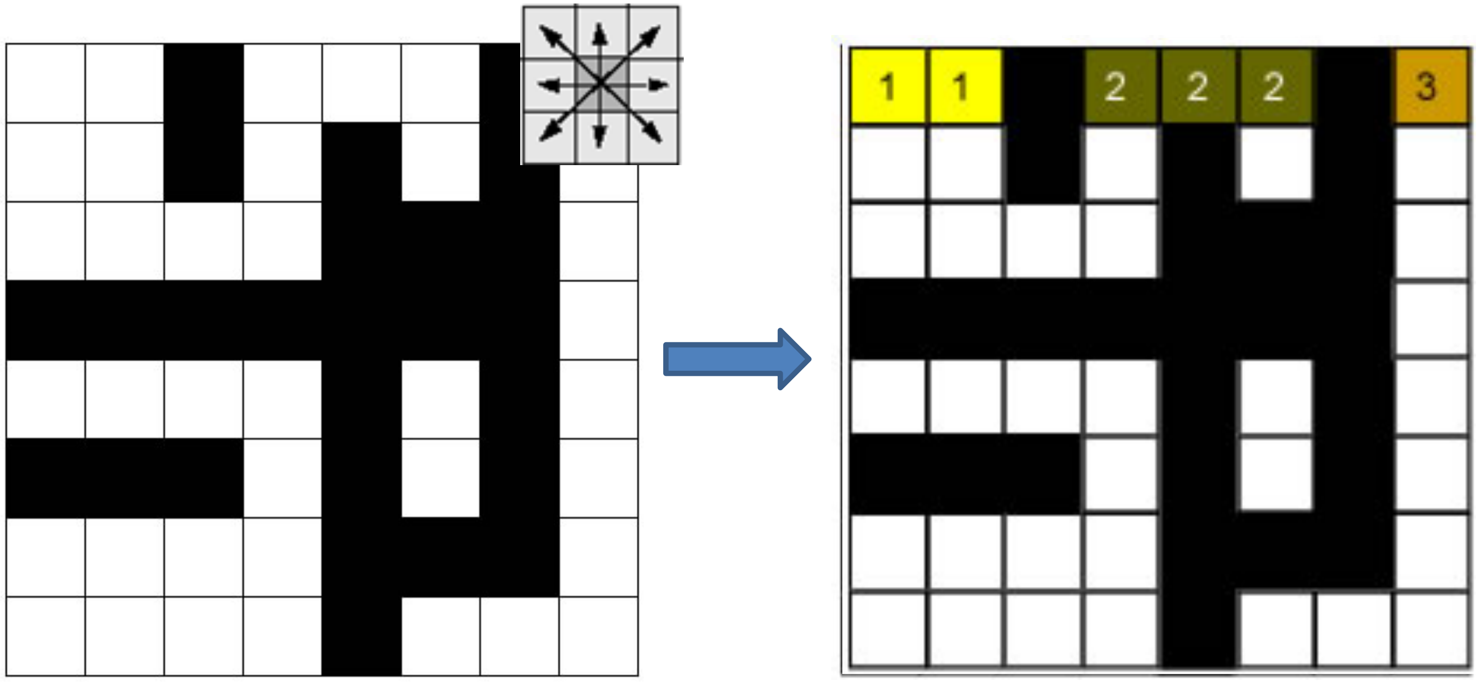

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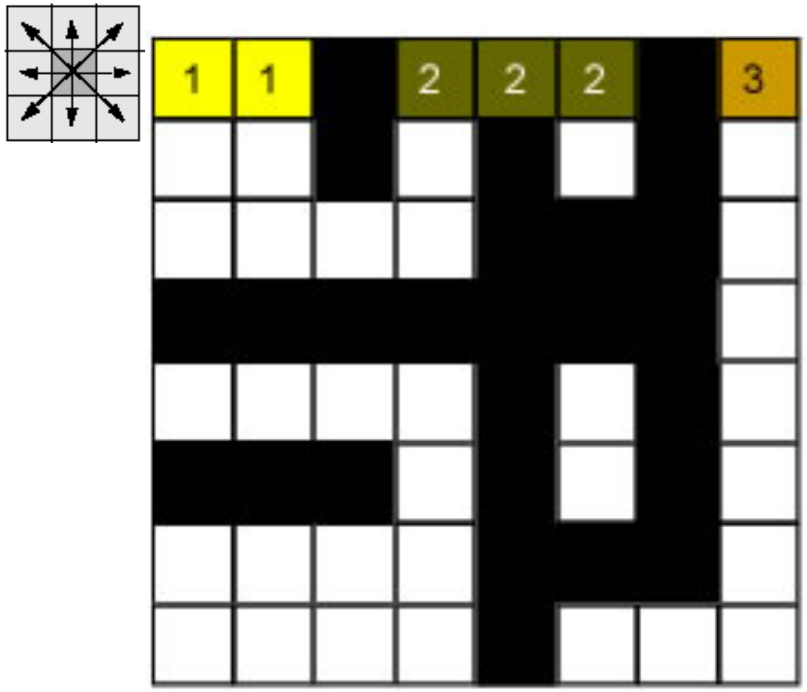

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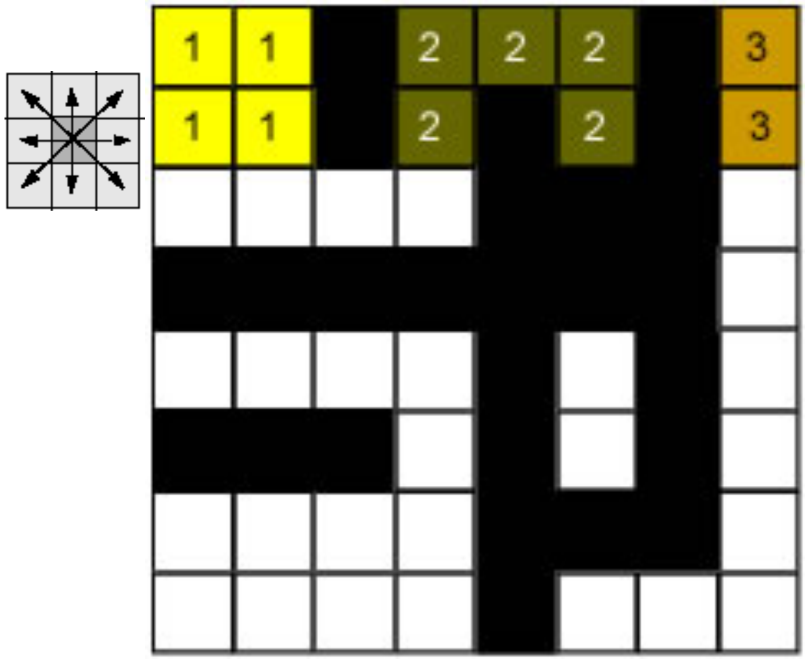
- **Pass #1:**
  - **Row #2**



Row by Row Algorithm

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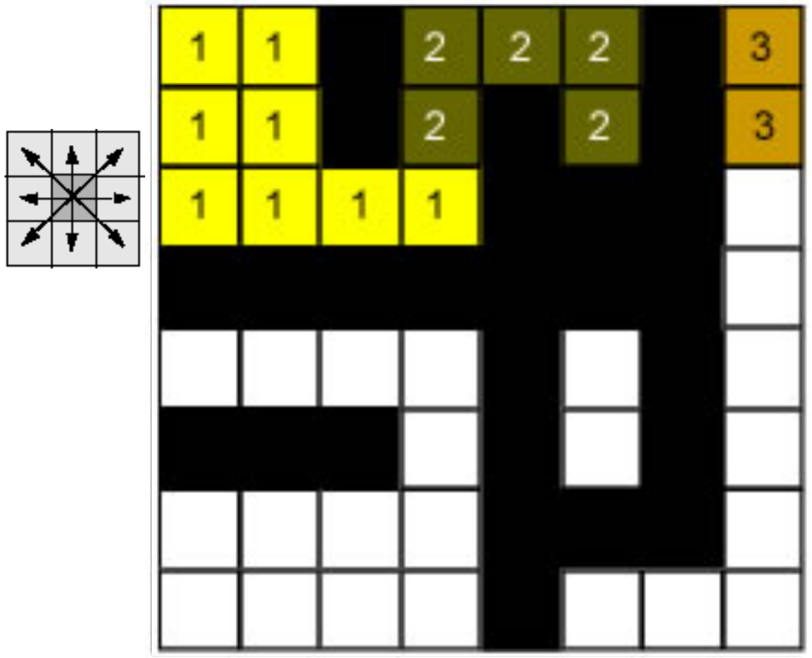
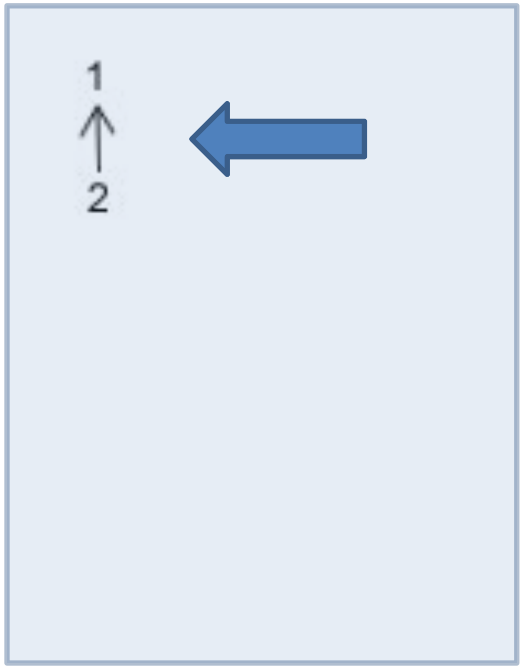
Adjacent labels

Union-Find

- **Pass #1:**
  - **Row #3**





Row by Row Algorithm

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  - If the center falls in a non-zero pixel, label it!
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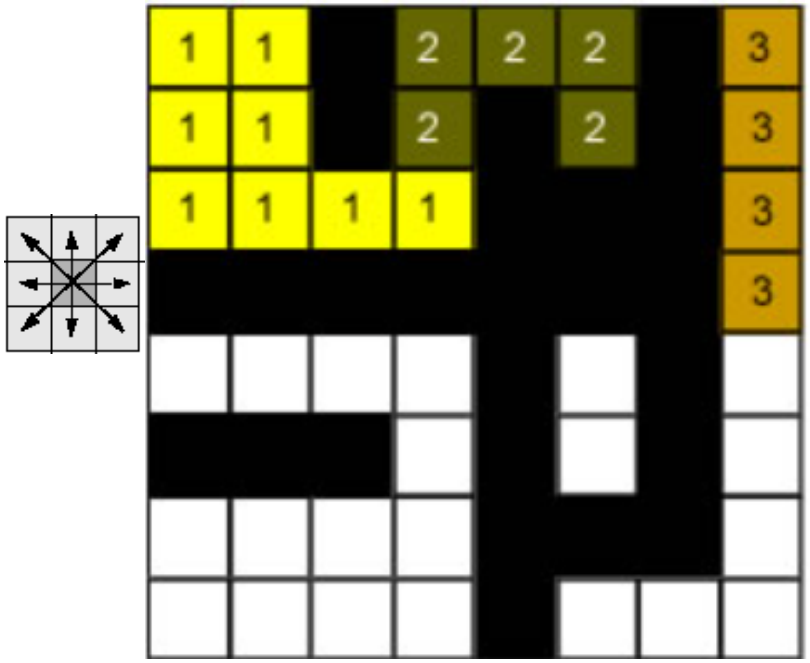
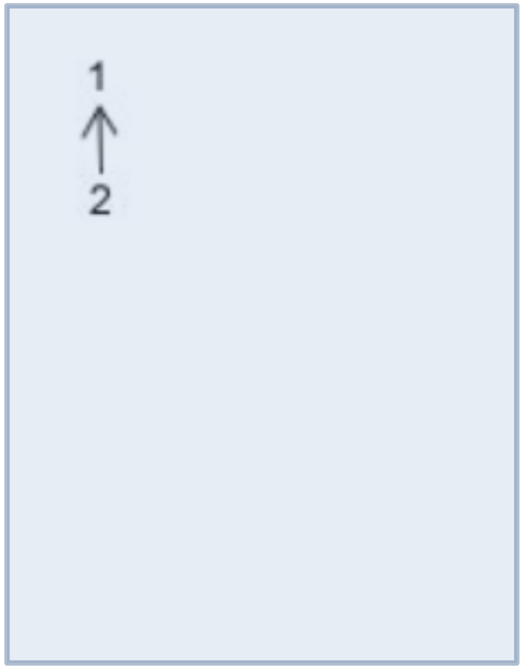
- **Pass #1:**
  - **Row #4**



Union-Find



Row by Row Algorithm

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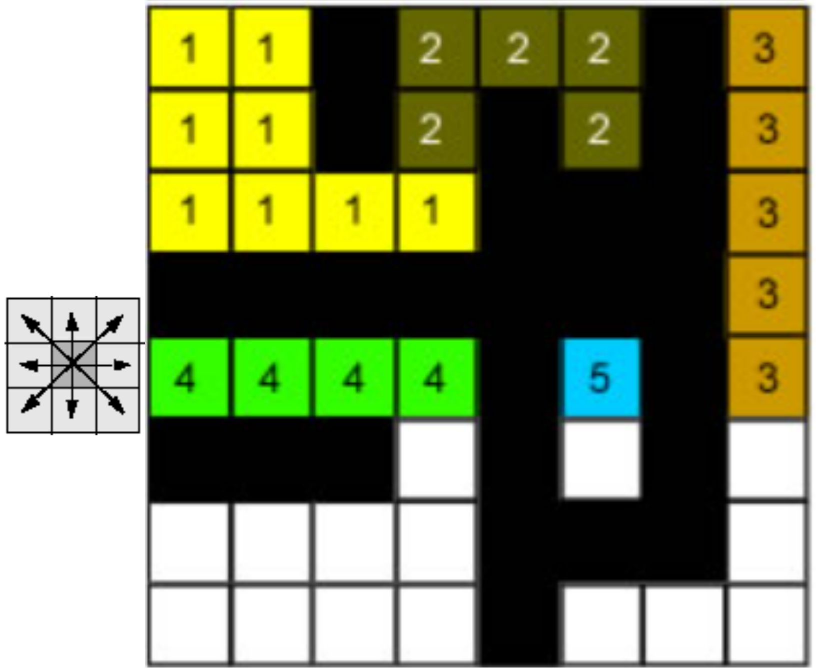
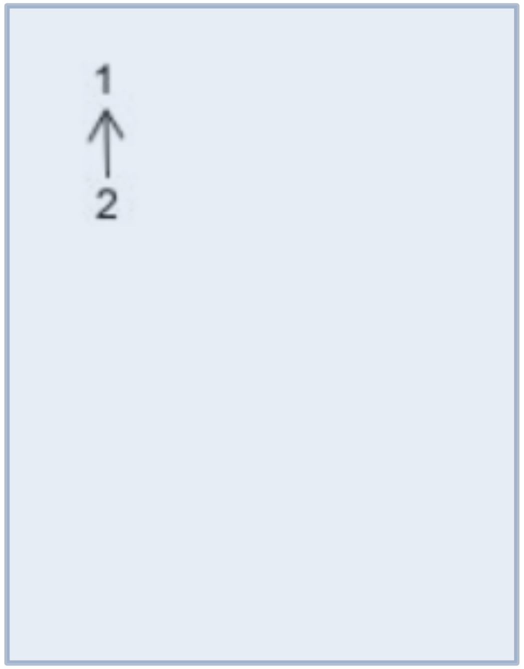
- **Pass #1:**
  - **Row #5**



Union-Find



Row by Row Algorithm

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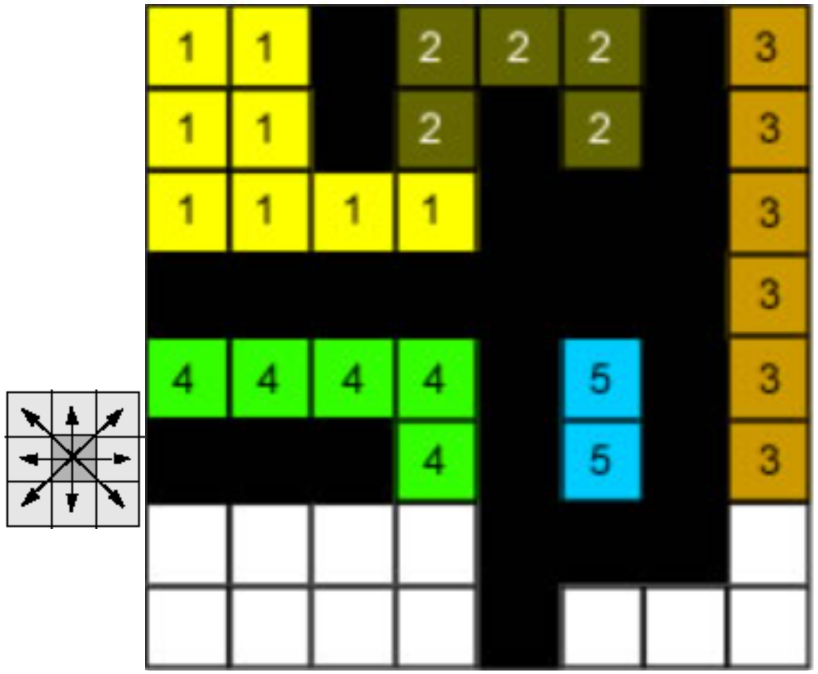
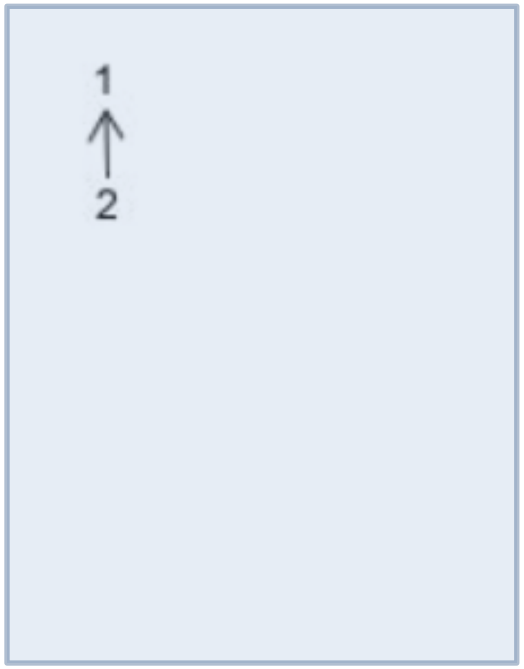
Union-Find

- **Pass #1:**
    - **Row #6**





Row by Row Algorithm

- Sliding a connectivity kernel , row by row (2 passes)
  - If the center falls in a non-zero pixel, label it!
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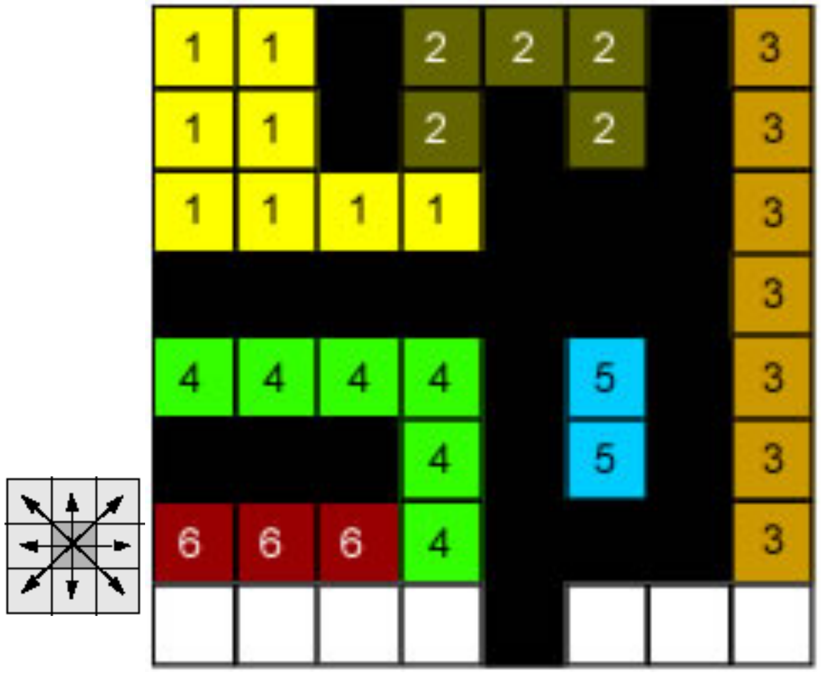
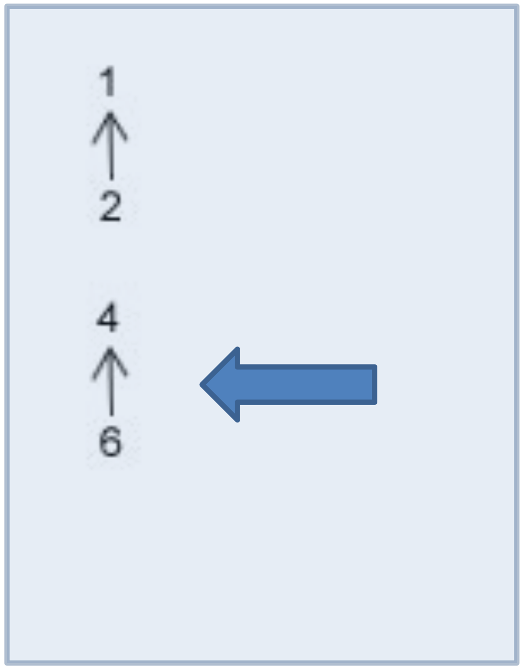
- **Pass #1:**
  - **Row #7**



Union-Find



Row by Row Algorithm

- Sliding a connectivity kernel , row by row (2 passes)
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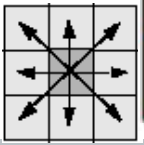
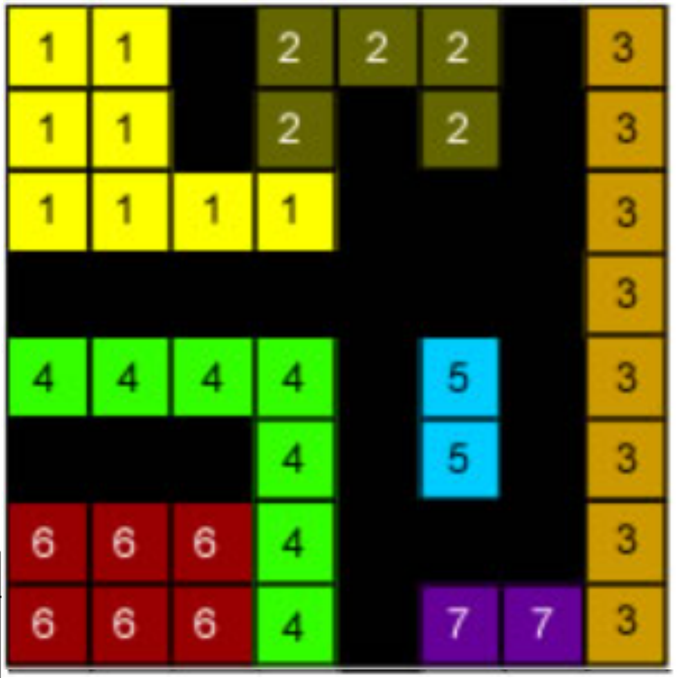
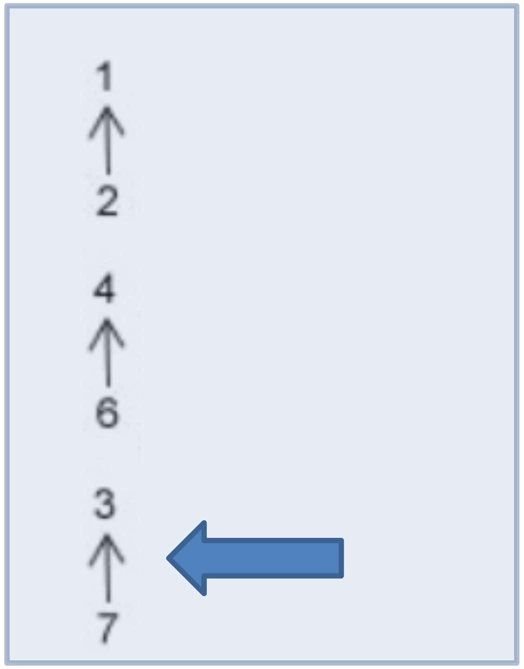
- **Pass #1:**





Union-Find



  - **Row #8**

Row by Row Algorithm

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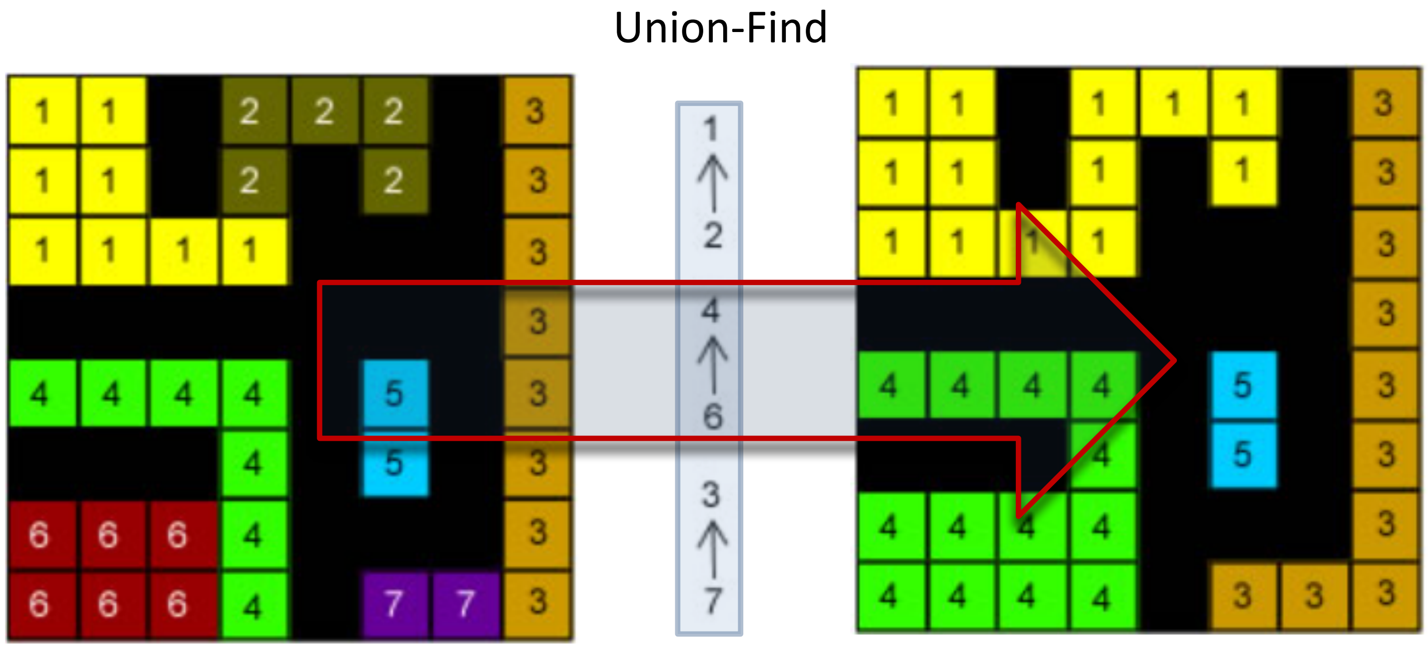
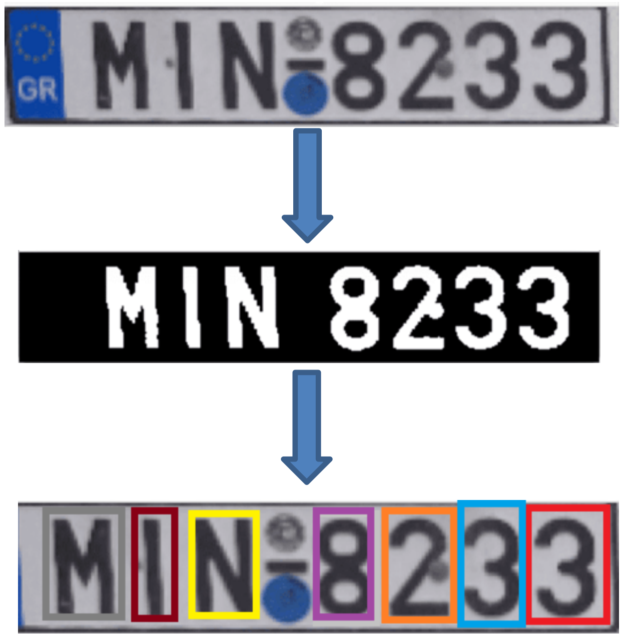
- **Pass #2:**

- **Resolve Union-Find**



Let’s Code!

- In our pratice, we will implement an algorithm to segment characters in a license plate.



- Besides, we will introduce the cv2.connectedComponent() that implements the component labeling method
- Checkout it here: [Lecture 04 - Finding Components.ipynb]()