# Prepoznavanje nonograma i njihovo rešavanje

Srđan Milaković

Soft Computing 2015

Fakultet tehničkih nauka

## Šta je nonogram?

 Nonograms, also known as Japanese crosswords, are picture logic puzzles in which cells in a grid must be colored or left blank according to numbers at the side of the grid to reveal a hidden picture.

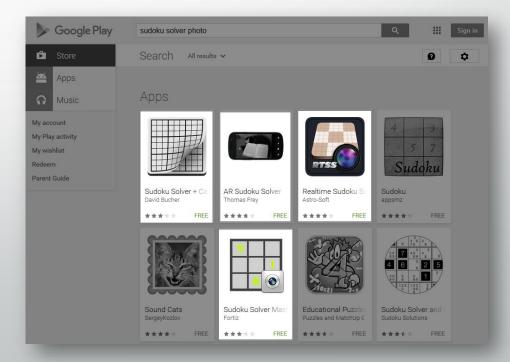
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### Motivacija

- Bubble Cup 7 round 1
- Challenge problem NP complete
- http://www.spoj.com/problems/JCROSS/
- C++ rešenje
- Oko 2000 linija koda

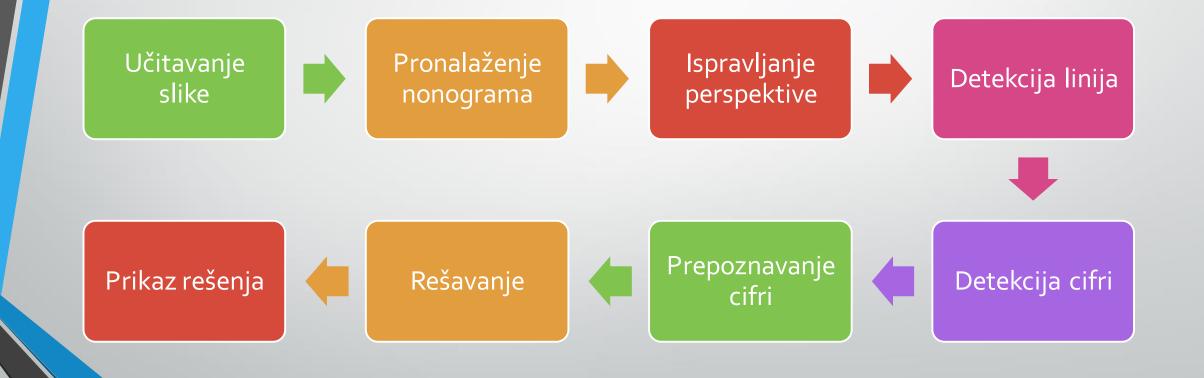
Postoje slične aplikacije za rešavanje soudokua



### Slična rešenja

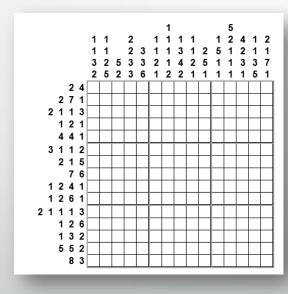
- An efficient algorithm for solving nonograms Chiung-Hsueh Yu, Hui-Lung Lee, Ling-Hwei Chen <a href="http://debut.cis.nctu.edu.tw/Publications/pdfs/J54.pdf">http://debut.cis.nctu.edu.tw/Publications/pdfs/J54.pdf</a>
- Object detection algorithms analysis and implementation for augmented reality system
   Rasa Zavistanavičiūtė, KAUNAS, 2012
  - Blob detection, Edge detection, Canny edge detector, Double thresholding, Sobel...
- IBM Printed Character Recognition (PCR)
  https://www.research.ibm.com/haifa/projects/image/ocr/pcr.html

## Algoritam



### Pronalaženje nonograma

- Binarizacija slike
  - Threshold
  - Canny edge detector
  - Image derivate
- Random sample consensus (RANSAC)
- Ramer–Douglas–Peucker algorithm

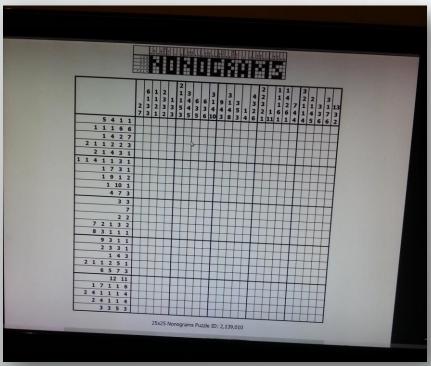


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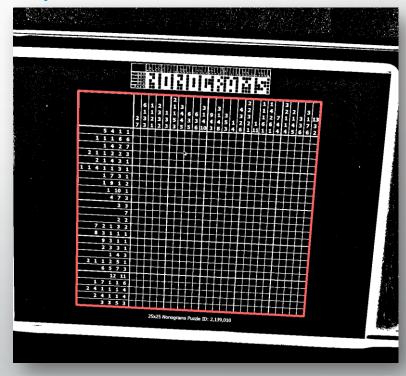
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### Pronalaženje nonograma

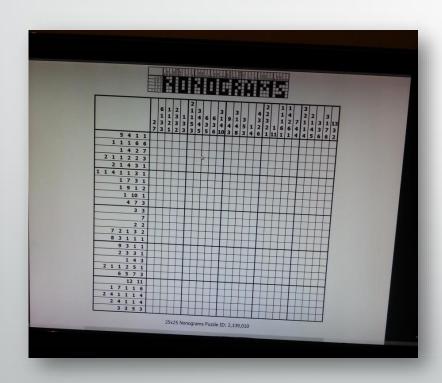
Originalna slika



Adaptive threshold + selection



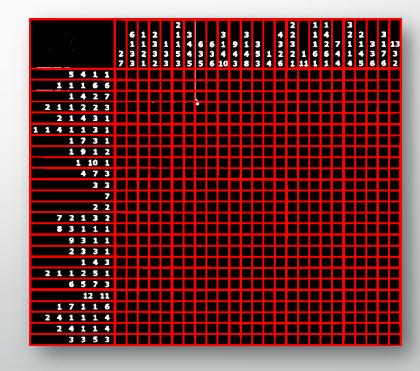
## Ispravljanje perspektive



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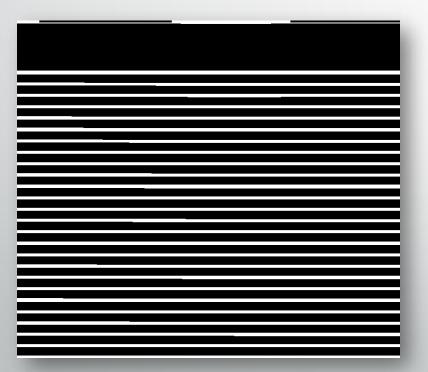
### Detekcija linija

- Standardna rešenja
  - Hough Line Transform
  - Probabilistic Hough Line Transform
- Kerneli n x m, n >> m ili m >> n
  - Blur
  - Fixed Threshold



## Detekcija linija

Kerneli n x m

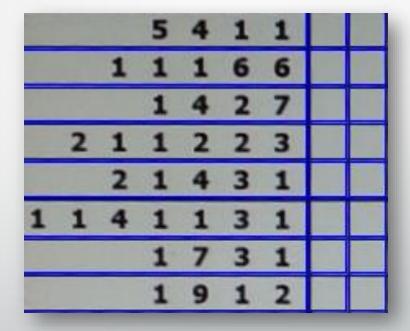


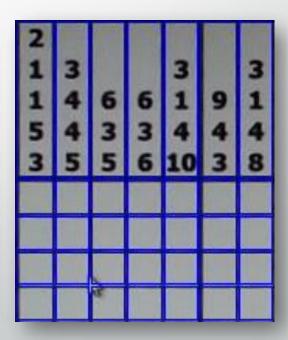
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## Detekcija cifri

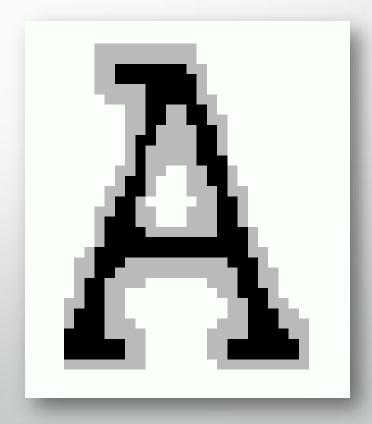
- Dve cifre ili dva broja?
- k-means
- DBSCAN
- Dilate + contours





### Prepoznavanje cifri

- Printed Character Recognition (PCR)
- Character masks
- Data set
- Mala greška
- Jedan font

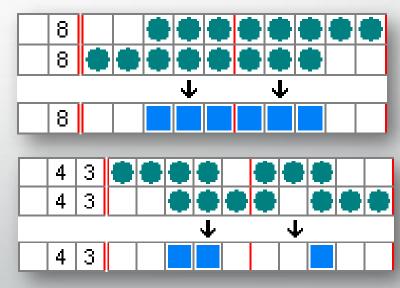


## Rešavanje

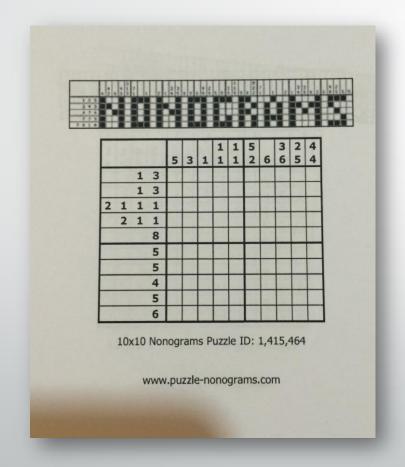
#### Algoritmi

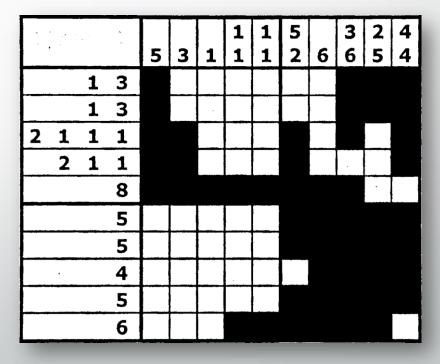
- Genetski algoritmi
- Depth first search
- Logička pravila
- Cython

#### Simple boxing



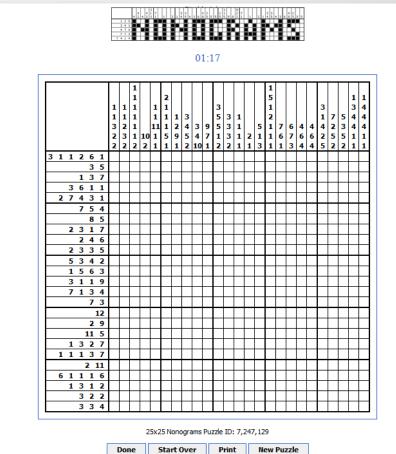
## Prikazivanje rešenja





## Verifikacija

- http://www.puzzle-nonograms.com/
- Do 20 x 20
- Crno beli nonogrami



## Rezultati i performanse

#### Samsung 18750

Veličina	Rezultat
5×5	5/5 - 100%
10X10	5/5 - 100%
15X15	3/5 - 60%
20X20	1/5 - 20%
25X25	1/5 - 20%

#### Huawei P7

Veličina	Rezultat
5×5	5/5 - 100%
10X10	5/5 - 100%
15X15	5/5 - 100%
20X20	5/5 - 100%
25X25	2/5 - 40%

#### IPhone 5S

Veličina	Rezultat
5×5	5/5 - 100%
10X10	5/5 - 100%
15X15	5/5 - 100%
20X20	5/5 - 100%
25X25	3/5 - 60%

## Neuspešni testovi

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# Hvala na pažnji

Srđan Milaković

srdjan.milakovic@outlook.com