Multimedia: Puzzle matching

Groep 15: Francis Begyn
Youri Vassiliev

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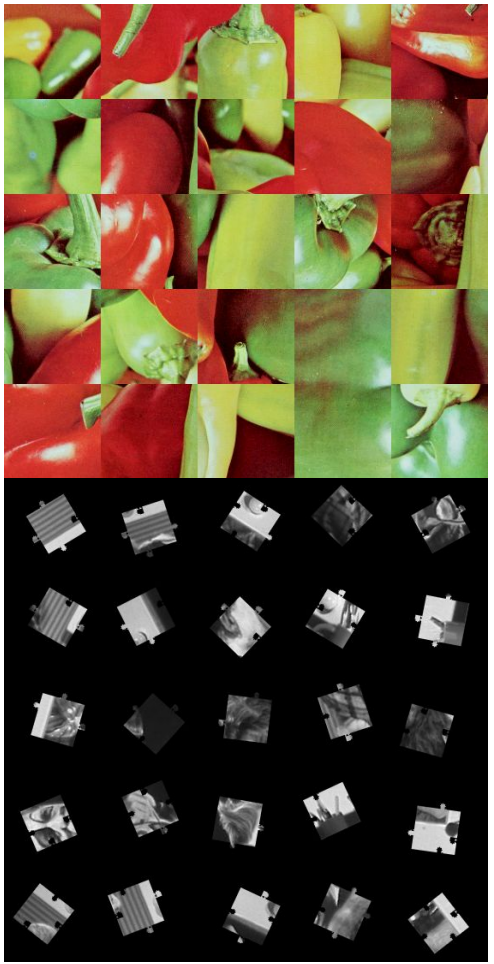
Project

Puzzel oplossen op basis van afbeelding



Uitdagingen

- Snelheid
- Schaalbaarheid
- Correctheid

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Methodiek

Planning	Onderzoek	Implementatie
Bepalen welke van de uitdaging er prioritair is. Keuze: ● Prio1: snelheid ● Prio2: correctheid ● Prio3: schaalbaarheid Structuur van het programma	Opzoekwerk naar wat de beste methoden Bibliotheken gebruiken? Zelf schrijven?	Implementeren van geteste methodes

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Structuur programma

2 klassen

Puzzle
- Puzzel opslaan
- Puzzelstukjes opslaan
- Elementaire bewerking van afbeelding

Puzzlesolver
- Oplossen van puzzel
- Samenstellen van oplossing
- Matchingalgoritmes

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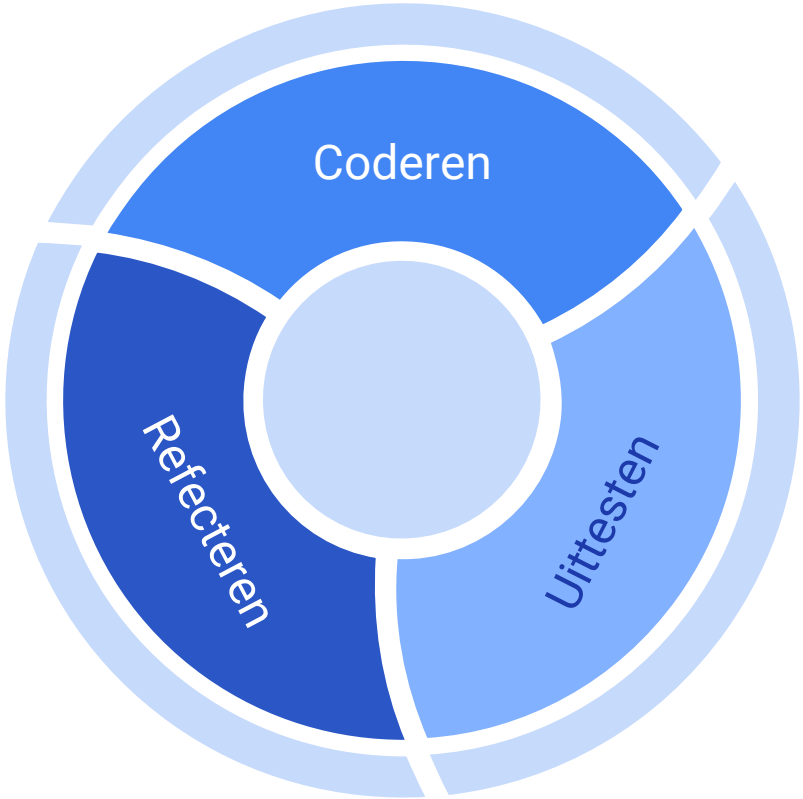
Implementatie: (Francis)

Implementatie bestaat uit meerdere stappen

- Coderen: uitvoeren van idee
- Uittesten: zoveel mogelijk cases testen
- Reflecteren: wat ging er fout? Hoe kan dit beter?



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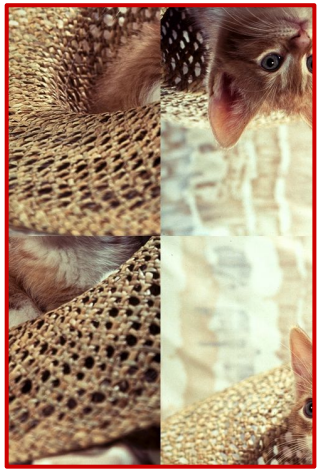
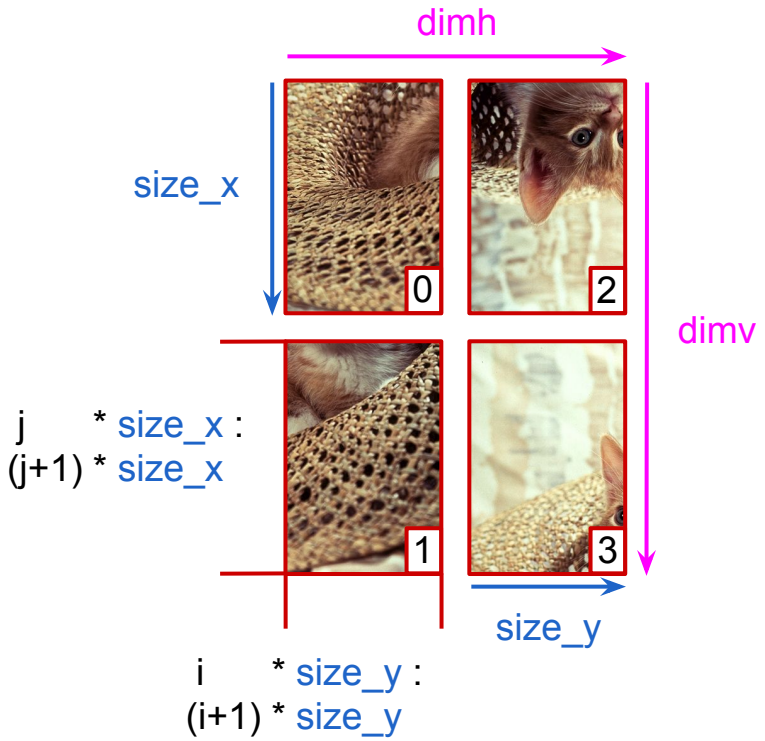
Pre-processing: shuffled/rotated tiles



tiles_rotated_2x2_02.png

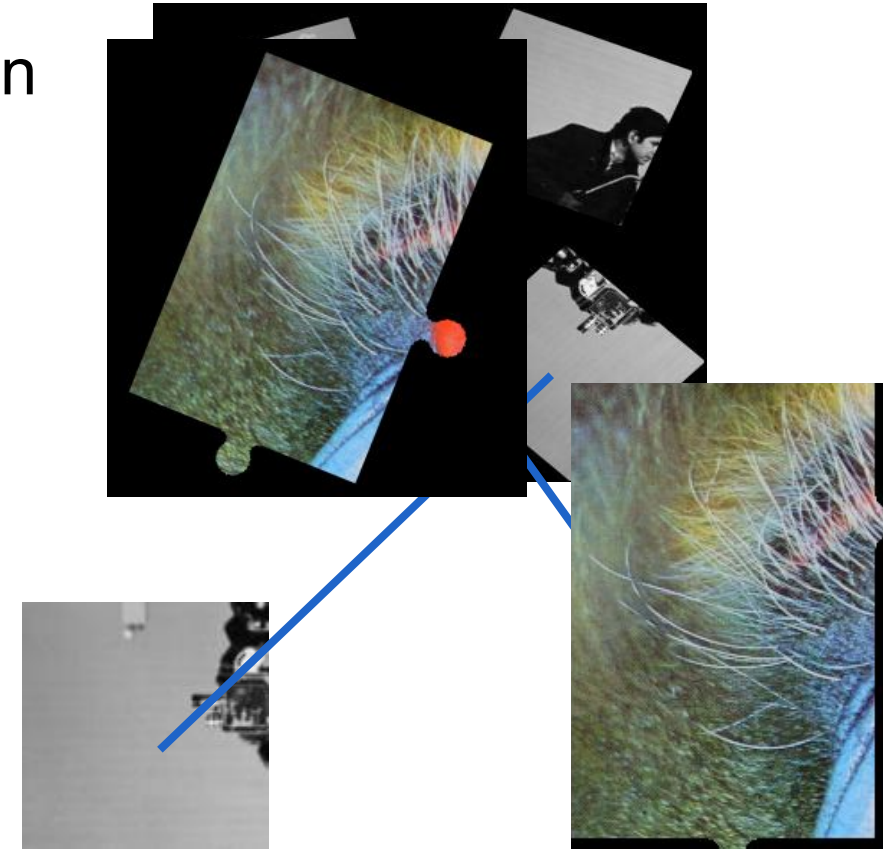
dimv → Size_x = dimv / len(v)

dimh → Size_y = dimh / len(h)



Pre-processing: scrambled pieces

- Verschillende iteraties van algoritme geweest
  - Huidig: algoritme van Suzuki (cv.findContours)
- Werkt nu voor tiles, niet zo voor jigsaw stukjes



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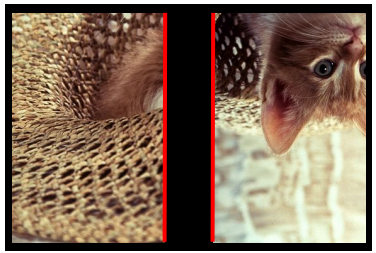
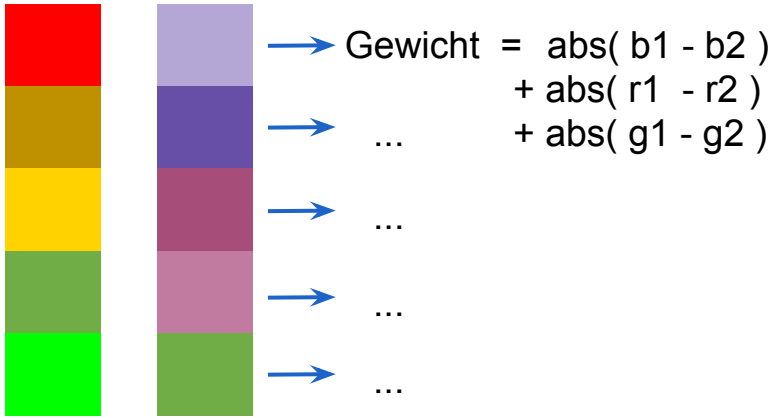
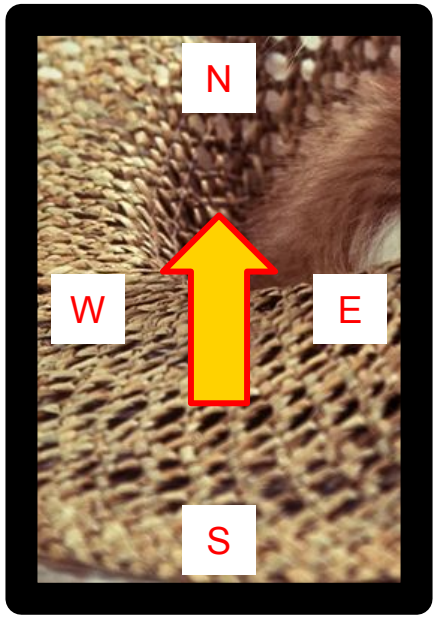
afstands bepalling

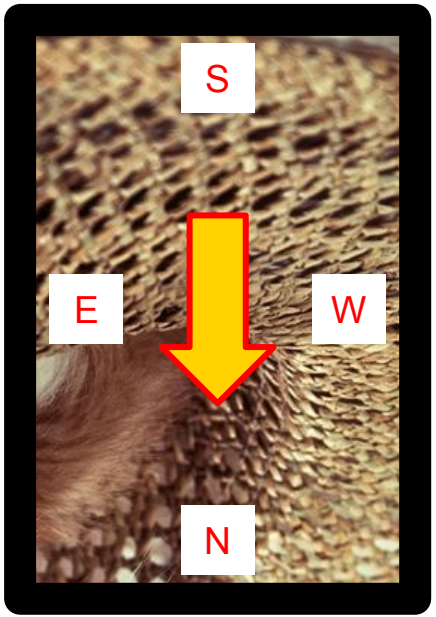


slice 1 slice 2



edge slicing: conventie





richting	index
North	0
East	1
South	2
West	3

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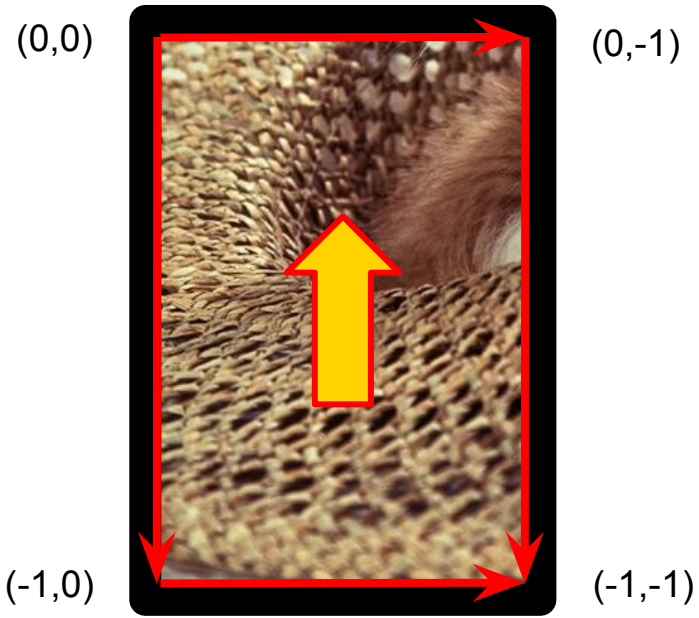
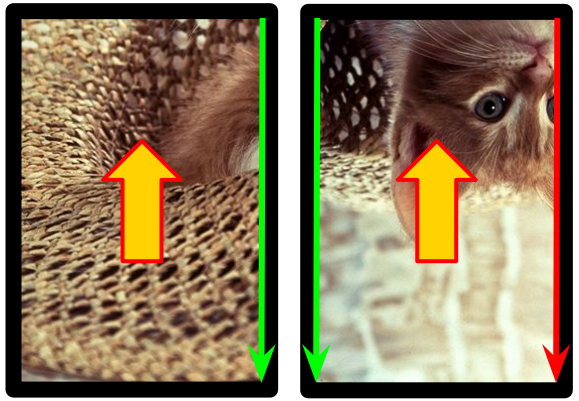
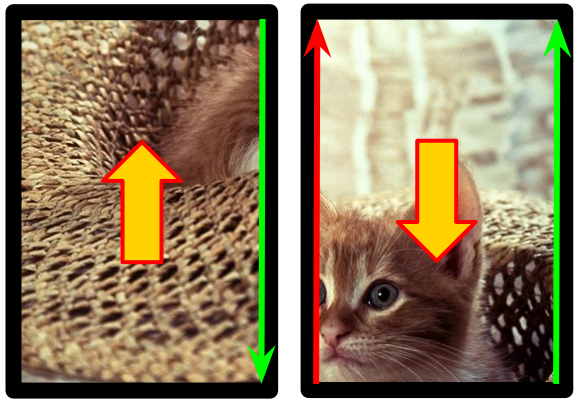
edge slicing: richting





OK



fout

edge slicing: richting

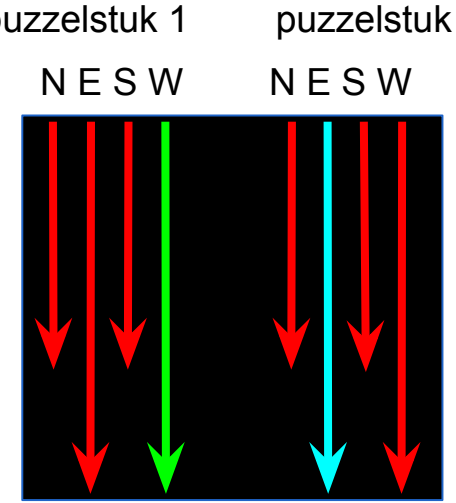
[0,-1::-step]

[-1::-step,0]

[-1::-step,-1]

[-1 , -1::-step]

Look-up-table opstellen



LUT : afstand

	0	1	2	3
0	x			
1		x		
2			x	
3				x

[1,2]

	N2	E2	S2	W2
N1		99		99
E1	99		99	
S1		99		99
W1	99		99	

Transpose

[2,1]

	N1	E1	S1	W1
N2		99		99
E2	99		99	
S2		99		99
W2	99		99	

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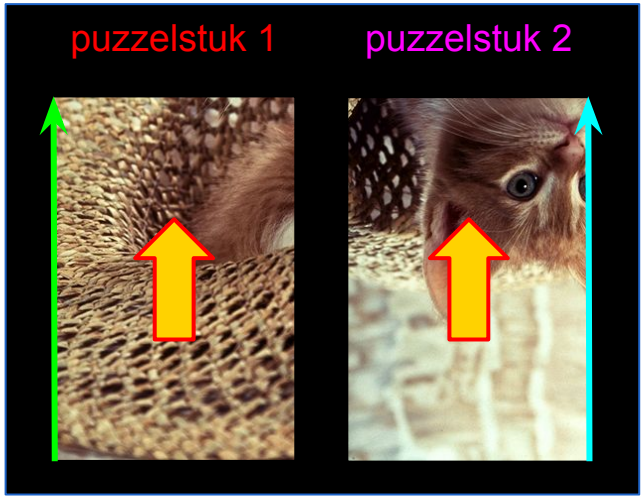
Look-up-table voorbeeld



LUT : afstand

	0	1	2	3
0	x			
1		x		
2			x	
3				x

LUT: matches
[puzzelstuk 1,
puzzelstuk 2,
edge puzzelstuk 1,
edge puzzelstuk 2]
= gewicht

	N2	E2	S2	W2
N1		99		99
E1	99		99	
S1		99		99
W1	99		99	

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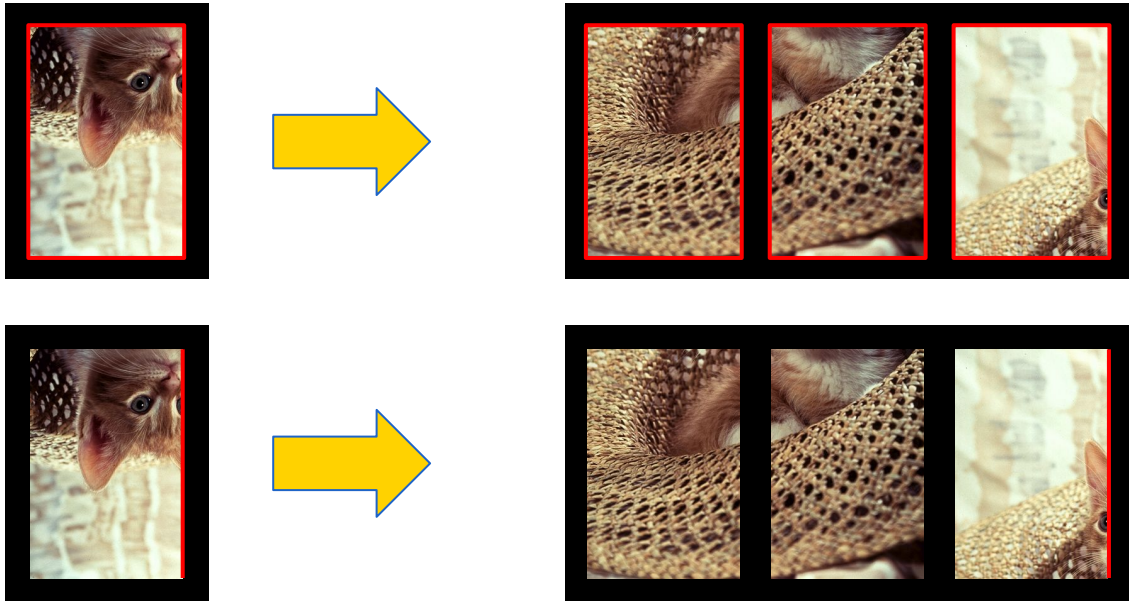
look-up-table mapping



LUT: afstand
[puzzelstuk 1,
puzzelstuk 2,
edge puzzelstuk 1,
edge puzzelstuk 2]
= afstand

LUT: matches
[puzzelstuk 1,
edge puzzelstuk 1]
= [stuk, edge, afstand]

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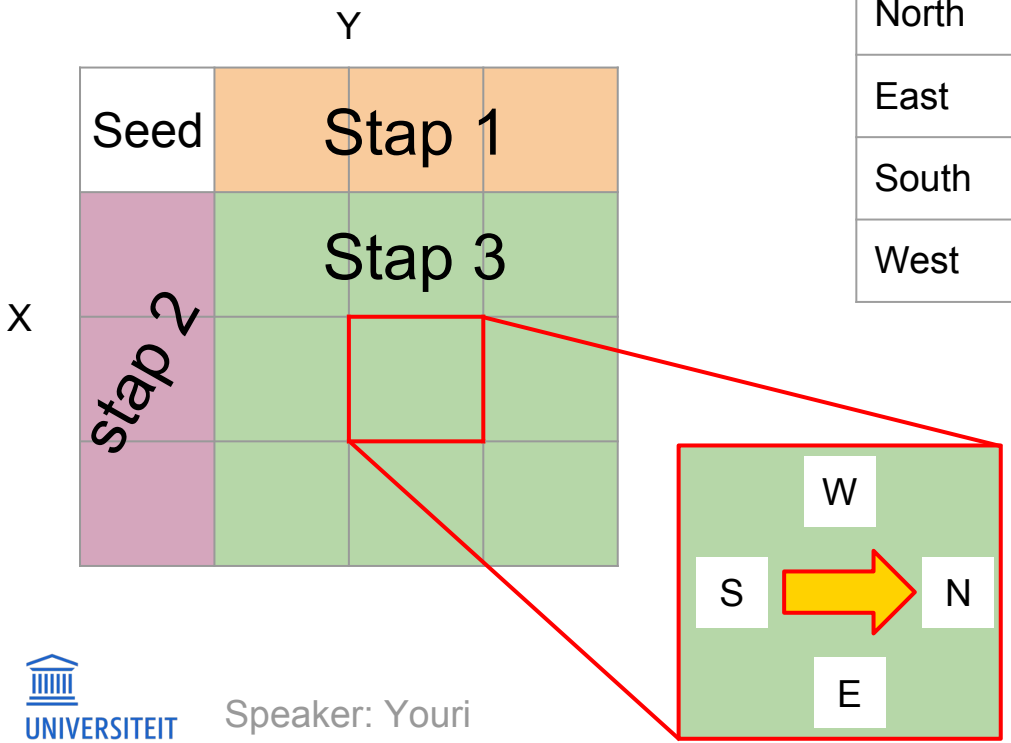
beste match



richting	index
North	0
East	1
South	2
West	3

LUT: matches
[puzzelstuk 1,
edge puzzelstuk 1]
= [stuk, edge, afstand]

best match
[x, y] =
[stuk , top edge]

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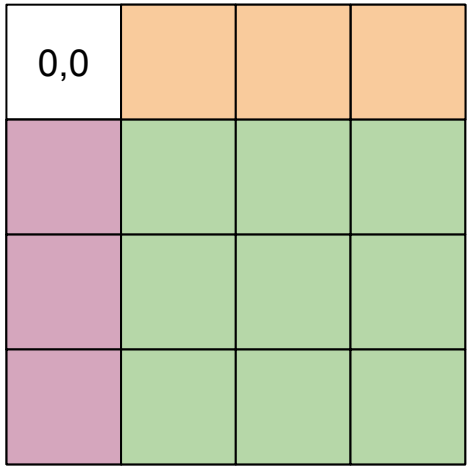
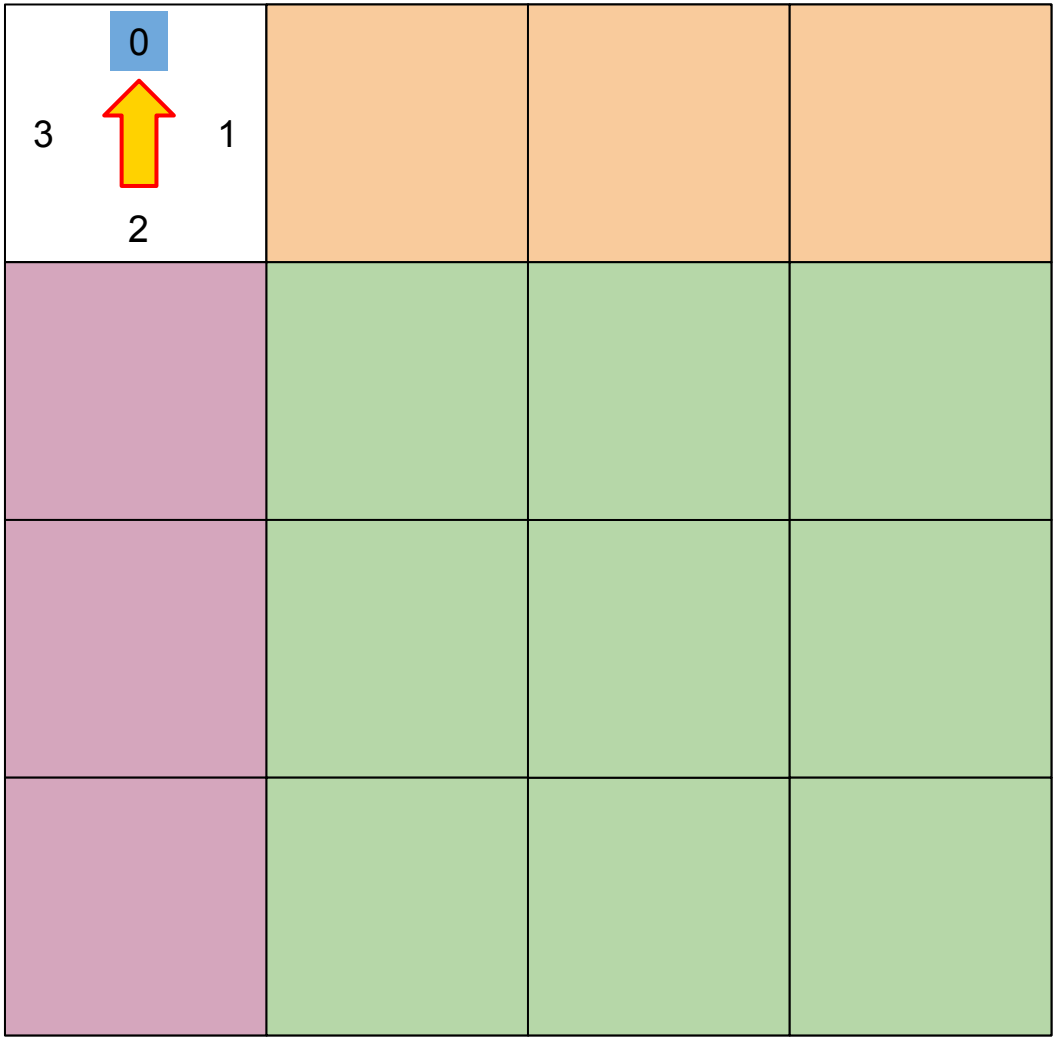
beste match



LUT: matches
[puzzelstuk 1,
edge puzzelstuk 1]
= [stuk, edge, afstand]



rotatie reductie

-90° => +1 rot

0,0	1,1	2,1	3,1
4,2	7,3	8,3	9,3
5,2	10,3	11,3	12,3
6,2	13,3	14,3	15,3

	⇧	⇦	⇩	⇨
rotatie	0	1	2	3
telling	1	3	3	9

=> 15

3,2	9,0	12,0	15,0	
2,2	8,0	11,0	14,0	
1,2	7,0	10,0	13,0	
0,1	4,3	5,3	6,3	

	⇧	⇦	⇩	⇨
rotatie	0	1	2	3
telling	9	1	3	3

=> 7

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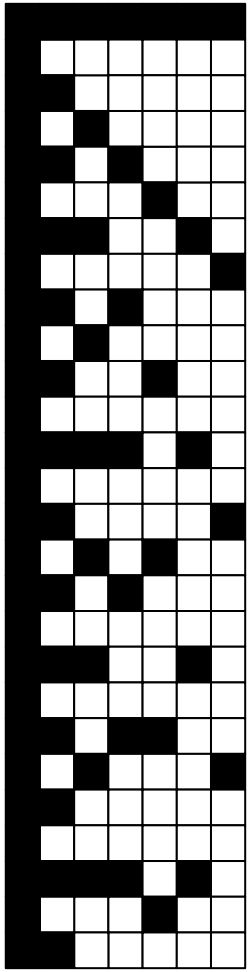
resultaten



step size	error (/45)	match (/45)	match (%)	avg time (sec)	sec / match (s)
1	6	39	86,67%	6,724	0,1724
2	7	38	84,44%	3,571	0,0940
3	5	40	88,89%	2,433	0,0608
4	8	37	82,22%	1,906	0,0515
5	6	39	86,67%	1,582	0,0406
6	2	43	95,56%	1,357	0,0316
7	5	40	88,89%	1,215	0,0304
8	7	38	84,44%	1,084	0,0285
9	6	39	86,67%	1,001	0,0257
10	6	39	86,67%	0,938	0,0241
11	9	36	80,00%	0,872	0,0242
12	7	38	84,44%	0,828	0,0218

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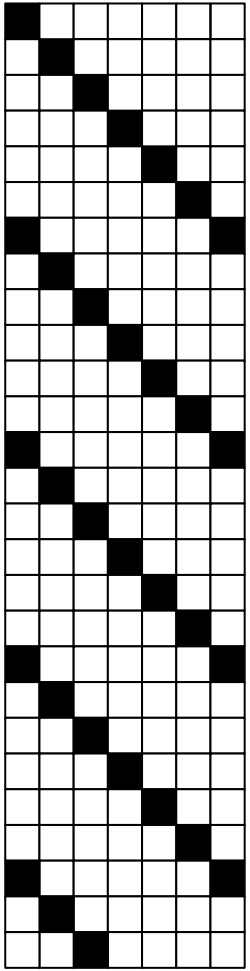
resultaten



Stap = 6

step offset	error (/45)	match (/45)	match (%)
0	2	43	95,56%
1	5	40	88,89%
2	7	38	84,44%
3	7	38	84,44%
4	7	38	84,44%
5	8	37	82,22%
6	4	41	91,11%

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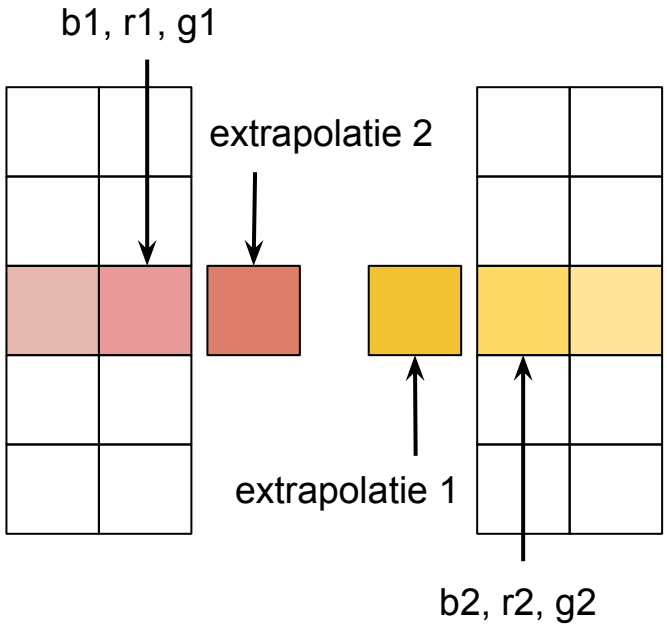
resultaten

Gewicht = abs(b1 - extr(b1)) + abs(b2 - extr(b2))
+ abs(r1 - extr(r1)) + abs(r2 - extr(r2))
+ abs(g1 - extr(g1)) + abs(g2 - extr(g2))



step size	error (/45)	match (/45)	match (%)	avg time (sec)	sec / match (s)
1	7	38	84,44%	29,116	0,766
2	7	38	84,44%		
3	6	39	86,67%		
4	5	40	88,89%		
5	8	37	82,22%	6,036	0,163
6	8	37	82,22%	5,061	0,137

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resultaten

Scipy.spatial.distance
Stap = 1

type distance	error (/45)	match (/45)	match (%)	avg time (sec)	sec / match (s)
braycurtis	8	37	82,22%	2,209	0,0597
canberra	8	37	82,22%	4,101	0,1108
chebyshev	14	31	68,89%	2,564	0,0827
cityblock	6	39	86,67%	1,79	0,0459
correlation	5	40	88,89%	7,595	0,1899
cosine	11	34	75,56%	5,38	0,1582
euclidean	8	37	82,22%	2,257	0,0610
minkowski	8	37	82,22%	2,207	0,0596
sqeuclidean	16	29	64,44%	1,761	0,0607
hamming	11	34	75,56%	2,742	0,0806

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resultaten

correlation

step size	error (/45)	match (/45)	match (%)	avg time (sec)	sec / match (s)
1	5	40	88,89%	7,595	0,1899
2	4	41	91,11%	7,435	0,1813
3	6	39	86,67%	7,418	0,1902
4	5	40	88,89%	7,31	0,1828
5	9	36	80,00%	7,322	0,2034
6	9	36	80,00%		
7	8	37	82,22%		
8	12	33	73,33%		

cityblock

step size	error (/45)	match (/45)	match (%)	avg time (sec)	sec / match (s)
1	6	39	86,67%	1,79	0,0459
2	7	38	84,44%	1,736	0,0457
3	5	40	88,89%	1,725	0,0431
4	8	37	82,22%	1,723	0,0466
5	6	39	86,67%	1,71	0,0438
6	2	43	95,56%	1,716	0,0399
7	6	39	86,67%	1,716	0,0440
8	7	38	84,44%	1,704	0,0448

resultaten

Convolutie

kernel1	kernel2	error (/45)	match (/45)	match (%)	avg time (sec)	sec / match (s)
	[1,1,1]	4	41	91,11%	8,732	0,2130
[3,0,-3]	[8,8,8]	4	41	91,11%		
[3,0,-3]	[7,10,7]	4	41	91,11%		
[6,0,-6]	[1,22,1]	6	39	86,67%		
[6,1,0,-1,-6]	[2,4,6,4,2]	4	41	91,11%	9,518	0,2321
[6,1,0,-1,-6]	[6,24,39,24,6]	13	32	71,11%		
[1,0,-3,0,1]	[0,2,3,2,0]	4	41	91,11%		
[4,12,0,–12,-4]	[2,12,19,12,2]	9	36	80,00%		
[2,6,1,0,-1,-6,-2]	[1,2,4,6,4,2,1]	4	41	91,11%	9,958	0,2429
[2,6,1,0,-1,-6,-2]		11	34	75,56%	9,156	0,2693

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Mapping - resultaten

Geen methode die alles goed oplost

Meerdere methodes achter elkaar toepassen als een zeef

	substraction	extrapolation	cityblock	correlation	hamming	Convolution	total
2x2_00	1	1	1	1	1	1	6
2x2_01	0	0	0	1	1	0	2
2x2_02	1	1	1	1	1	1	6
2x2_03	1	1	1	1	1	1	6
2x2_04	1	1	1	1	1	1	6
2x2_05	1	1	1	1	1	1	6
2x2_06	1	1	1	1	1	1	6
2x2_07	1	1	1	1	1	1	6
2x2_08	1	1	1	1	1	1	6
2x3_00	1	1	1	1	1	1	6
2x3_01	1	1	1	1	1	1	6
2x3_02	1	1	1	1	1	1	6
2x3_03	1	1	1	1	1	1	6
2x3_04	1	1	1	1	1	1	6
2x3_05	0	0	0	1	1	1	3
2x3_06	1	1	1	1	1	1	6
2x3_07	1	1	1	1	1	1	6
2x3_08	1	1	1	1	1	1	6
3x3_00	1	1	1	1	1	1	6
3x3_01	1	0	1	0	0	1	3
3x3_02	1	1	1	1	1	1	6
3x3_03	0	1	0	0	0	0	1
3x3_04	1	1	1	1	1	1	6
3x3_05	0	0	0	1	1	1	3
3x3_06	1	1	1	1	1	1	6
3x3_07	1	1	1	1	1	1	6
3x3_08	1	1	1	1	1	1	6
4x4_00	1	1	1	1	0	1	5
4x4_01	0	0,1	0	0	0	0	0
4x4_02	1	1	1	1	1	1	6
4x4_03	1	1	1	0	0	1	4
4x4_04	1	1	1	1	1	1	6
4x4_05	1	1	1	1	1	1	6
4x4_06	1	1	1	1	0,1	1	5
4x4_07	1	1	1	1	1	1	6
4x4_08	1	1	1	1	1	1	6
5x5_00	0	0	0	0	0	0	0
5x5_01	1	0,1	1	1	0	1	4
5x5_02	1	1	1	1	0	1	5
5x5_03	1	1	1	1	0	1	5
5x5_04	1	1	1	1	1	1	6
5x5_05	1	1	1	1	1	1	6
5x5_06	1	1	1	1	1	1	6
5x5_07	1	1	1	1	1	1	6
5x5_08	1	1	1	1	0,1	1	5
solutions	39	38	39	40	34	41	43
%	87%	84%	87%	89%	76%	91%	96%
time	6,724	29,12	1,79	7,595	2,742	8,732	
match/s	0,172	0,766	0,046	0,19	0,081	0,213	

image		substraction	extrapolation	cityblock	correlation	hamming	Convolution	total
0	2x2_00	1	1	1	1	1	1	6
0	2x3_00	1	1	1	1	1	1	6
0	3x3_00	1	1	1	1	1	1	6
0	4x4_00	1	1	1	1	0	1	5
0	5x5_00	0	0	0	0	0	0	0
1	2x2_01	0	0	0	1	1	0	2
1	2x3_01	1	1	1	1	1	1	6
1	3x3_01	1	0	1	0	0	1	3
1	4x4_01	0	0,1	0	0	0	0	0
1	5x5_01	1	0,1	1	1	0	1	4
2	2x2_02	1	1	1	1	1	1	6
2	2x3_02	1	1	1	1	1	1	6
2	3x3_02	1	1	1	1	1	1	6
2	4x4_02	1	1	1	1	1	1	6
2	5x5_02	1	1	1	1	0	1	5
3	2x2_03	1	1	1	1	1	1	6
3	2x3_03	1	1	1	1	1	1	6
3	3x3_03	0	1	0	0	0	0	1
3	4x4_03	1	1	1	0	0	1	4
3	5x5_03	1	1	1	1	0	1	5
4	2x2_04	1	1	1	1	1	1	6
4	2x3_04	1	1	1	1	1	1	6
4	3x3_04	1	1	1	1	1	1	6
4	4x4_04	1	1	1	1	1	1	6
4	5x5_04	1	1	1	1	1	1	6
5	2x2_05	1	1	1	1	1	1	6
5	2x3_05	0	0	0	1	1	1	3
5	3x3_05	0	0	0	1	1	1	3
5	4x4_05	1	1	1	1	1	1	6
5	5x5_05	1	1	1	1	1	1	6
6	2x2_06	1	1	1	1	1	1	6
6	2x3_06	1	1	1	1	1	1	6
6	3x3_06	1	1	1	1	1	1	6
6	4x4_06	1	1	1	1	0,1	1	5
6	5x5_06	1	1	1	1	1	1	6
7	2x2_07	1	1	1	1	1	1	6
7	2x3_07	1	1	1	1	1	1	6
7	3x3_07	1	1	1	1	1	1	6
7	4x4_07	1	1	1	1	1	1	6
7	5x5_07	1	1	1	1	1	1	6
8	2x2_08	1	1	1	1	1	1	6
8	2x3_08	1	1	1	1	1	1	6
8	3x3_08	1	1	1	1	1	1	6
8	4x4_08	1	1	1	1	1	1	6
8	5x5_08	1	1	1	1	0,1	1	5
	solutions	39	38	39	40	34	41	43
	%	87%	84%	87%	89%	76%	91%	96%
	time	6,724	29,12	1,79	7,595	2,742	8,732	
	match/s	0,172	0,766	0,046	0,19	0,081	0,213	

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Speaker: Youri

FACULTEIT INGENIEURSWETENSCHAPPEN
EN ARCHITECTUUR

Project - multimedia: Puzzle Solver

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Zijn er nog vragen?

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