Lab4

August 23, 2020

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1 Generacion de Imagenes y Metodos de Binarizacion

gDrive

1.1 Generacion de Imagenes

Los resultados se encuentran en la carpeta results/ImagenesGeneradas

1.2 Metodos de Binarizacion

1.2.1 Metodos Locales

Metodo Sauvola

Metodo Niblack

Metodo Bernsen

1.3 Resultados de los Metodos de Binarizacion

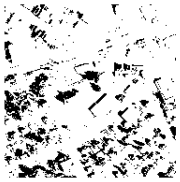
1.3.1 Imagenes

../images/westconcordorthophoto.png

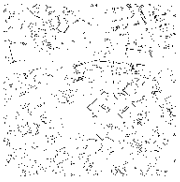
OTSU | 2.3663 | 140

KAPPUR | 2.516 | 140

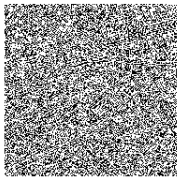
ISODATA | 2.5733 | 77



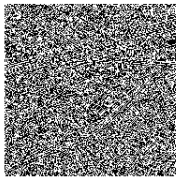
SAUVOLA | 0.015854 | [3 x 3]



NIBLACK | 0.014135 | [3 x 3]

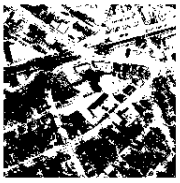


BERSEN | 0.021791 | [3 x 3]



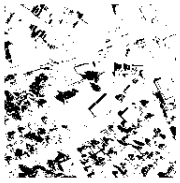
../images/westconcordorthophoto.png

OTSU | 2.3663 | 140

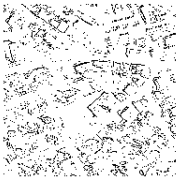


KAPPUR | 2.516 | 140

ISODATA | 2.5733 | 77



SAUVOLA | 0.014378 | [5 x 5]



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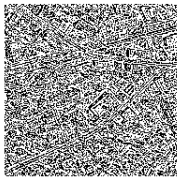
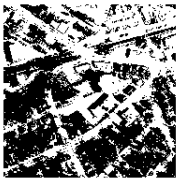


BERSEN | 0.017005 | [5 x 5]

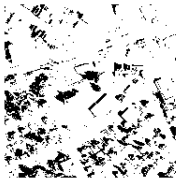
../images/westconcordorthophoto.png

OTSU | 2.3663 | 140

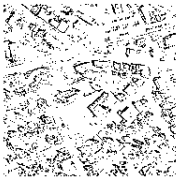


KAPPUR | 2.516 | 140

ISODATA | 2.5733 | 77



SAUVOLA | 0.015118 | [7 x 7]



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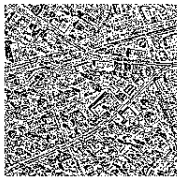


BERSEN | 0.017844 | [7 x 7]

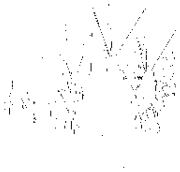
../images/boat.png

OTSU | 3.8083 | 103

KAPPUR | 3.8935 | 114

ISODATA | 3.9479 | 66

SAUVOLA | 0.026556 | [3 x 3]



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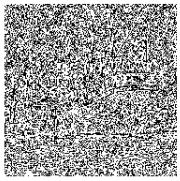
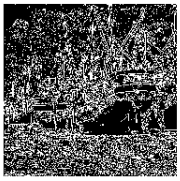


BERSEN | 0.031063 | [3 x 3]



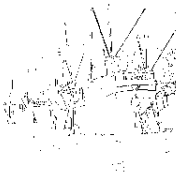
../images/boat.png

OTSU | 3.8083 | 103

KAPPUR | 3.8935 | 114

ISODATA | 3.9479 | 66

SAUVOLA | 0.025224 | [5 x 5]



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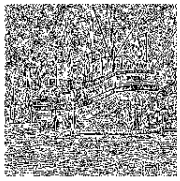


BERSEN | 0.031446 | [5 x 5]

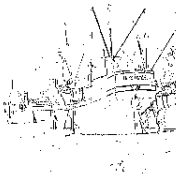
../images/boat.png

OTSU | 3.8083 | 103

KAPPUR | 3.8935 | 114

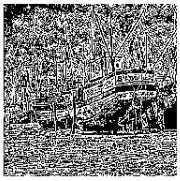
ISODATA | 3.9479 | 66

SAUVOLA | 0.0266 | [7 x 7]



NIBLACK | 0.026298 | [7 x 7]

BERSEN | 0.038094 | [7 x 7]



../images/cameraman.png

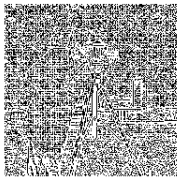
OTSU | 3.7203 | 109

KAPPUR | 3.8209 | 212

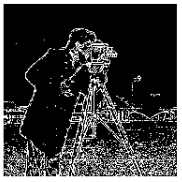
ISODATA | 3.8308 | 73

SAUVOLA | 0.022484 | [3 x 3]

NIBLACK | 0.022725 | [3 x 3]



BERSEN | 0.029315 | [3 x 3]



../images/cameraman.png

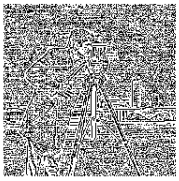
OTSU | 3.7203 | 109

KAPPUR | 3.8209 | 212

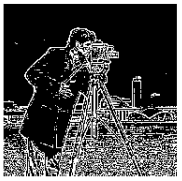
ISODATA | 3.8308 | 73

SAUVOLA | 0.022946 | [5 x 5]

NIBLACK | 0.023283 | [5 x 5]



BERSEN | 0.033072 | [5 x 5]



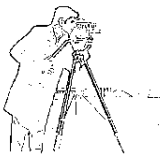
../images/cameraman.png

OTSU | 3.7203 | 109

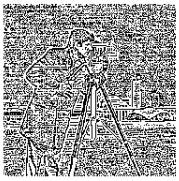
KAPPUR | 3.8209 | 212

ISODATA | 3.8308 | 73

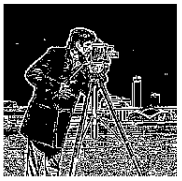
SAUVOLA | 0.024921 | [7 x 7]



NIBLACK | 0.023973 | [7 x 7]

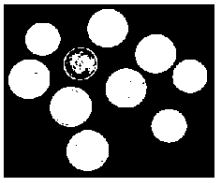


BERSEN | 0.033302 | [7 x 7]

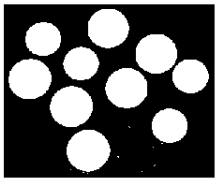


../images/coins.png

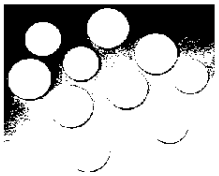
OTSU | 1.3259 | 127



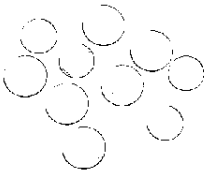
KAPPUR | 1.4526 | 78



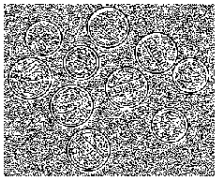
ISODATA | 1.5359 | 64



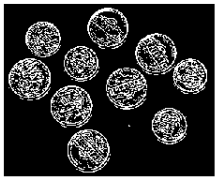
SAUVOLA | 0.0076511 | [3 x 3]



NIBLACK | 0.006907 | [3 x 3]

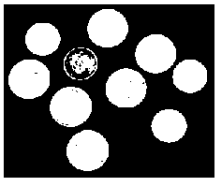


BERSEN | 0.0068691 | [3 x 3]

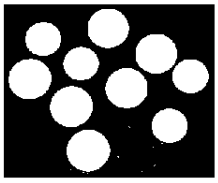


../images/coins.png

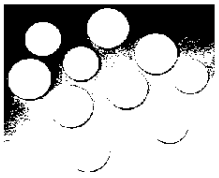
OTSU | 1.3259 | 127



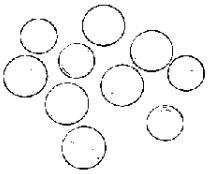
KAPPUR | 1.4526 | 78



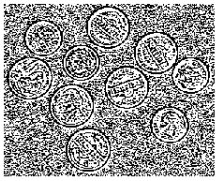
ISODATA | 1.5359 | 64



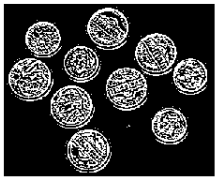
SAUVOLA | 0.009208 | [5 x 5]



NIBLACK | 0.0077009 | [5 x 5]

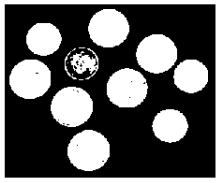


BERSEN | 0.0091481 | [5 x 5]

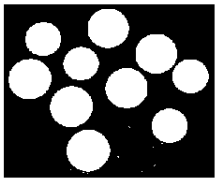


../images/coins.png

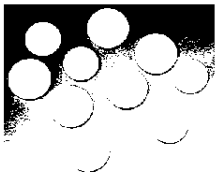
OTSU | 1.3259 | 127



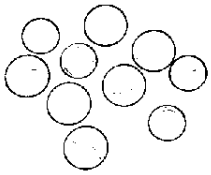
KAPPUR | 1.4526 | 78



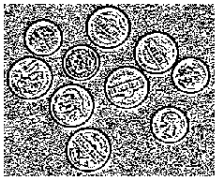
ISODATA | 1.5359 | 64



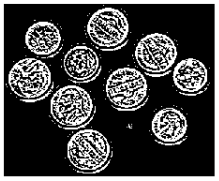
SAUVOLA | 0.008888 | [7 x 7]



NIBLACK | 0.007458 | [7 x 7]



BERSEN | 0.0094931 | [7 x 7]



../images/hands1.png

OTSU | 1.4101 | 170

KAPPUR | 1.336 | 168

ISODATA | 1.5341 | 132

SAUVOLA | 0.0076869 | [3 x 3]

NIBLACK | 0.0066018 | [3 x 3]

BERSEN | 0.0073812 | [3 x 3]

../images/hands1.png

OTSU | 1.4101 | 170

KAPPUR | 1.336 | 168

ISODATA | 1.5341 | 132

SAUVOLA | 0.0090251 | [5 x 5]

NIBLACK | 0.0072 | [5 x 5]

BERSEN | 0.0081031 | [5 x 5]

../images/hands1.png

OTSU | 1.4101 | 170

KAPPUR | 1.336 | 168

ISODATA | 1.5341 | 132

SAUVOLA | 0.0081248 | [7 x 7]

NIBLACK | 0.007035 | [7 x 7]

BERSEN | 0.009155 | [7 x 7]

../images/house.png

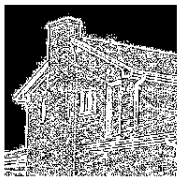
OTSU | 3.8133 | 172

KAPPUR | 3.8536 | 129

ISODATA | 3.7289 | 83

SAUVOLA | 0.022547 | [3 x 3]

NIBLACK | 0.022598 | [3 x 3]



BERSEN | 0.031157 | [3 x 3]

../images/house.png

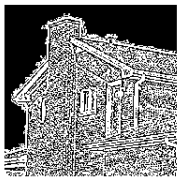
OTSU | 3.8133 | 172

KAPPUR | 3.8536 | 129

ISODATA | 3.7289 | 83

SAUVOLA | 0.026755 | [5 x 5]

NIBLACK | 0.021169 | [5 x 5]



BERSEN | 0.027384 | [5 x 5]

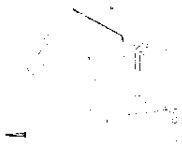
../images/house.png

OTSU | 3.8133 | 172

KAPPUR | 3.8536 | 129

ISODATA | 3.7289 | 83

SAUVOLA | 0.02535 | [7 x 7]

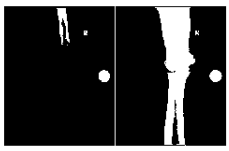


NIBLACK | 0.024018 | [7 x 7]

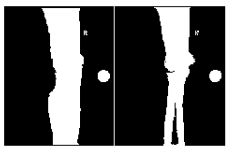
BERSEN | 0.026717 | [7 x 7]

../images/imagen1.png

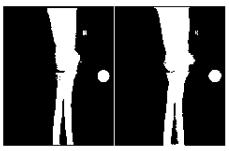
OTSU | 3.0018 | 127



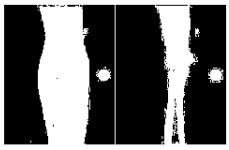
KAPPUR | 3.3678 | 29



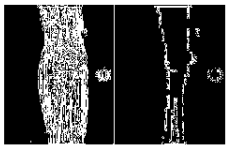
ISODATA | 3.4004 | 61



SAUVOLA | 0.017977 | [3 x 3]



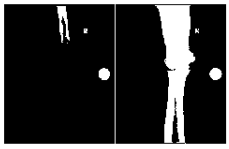
NIBLACK | 0.017537 | [3 x 3]



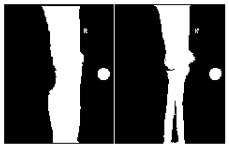
BERSEN | 0.021567 | [3 x 3]

../images/imagen1.png

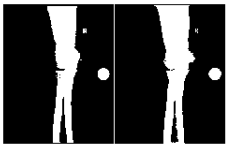
OTSU | 3.0018 | 127



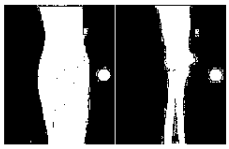
KAPPUR | 3.3678 | 29



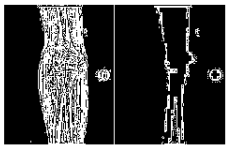
ISODATA | 3.4004 | 61



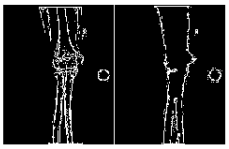
SAUVOLA | 0.018875 | [5 x 5]



NIBLACK | 0.017756 | [5 x 5]

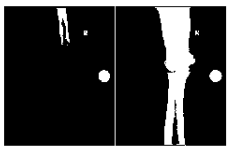


BERSEN | 0.02188 | [5 x 5]

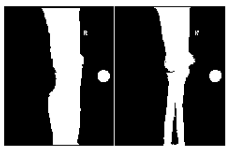


../images/imagen1.png

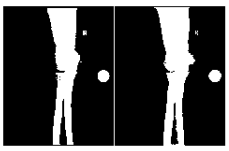
OTSU | 3.0018 | 127



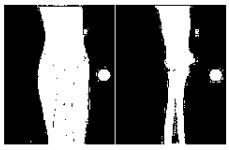
KAPPUR | 3.3678 | 29



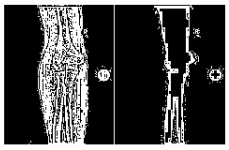
ISODATA | 3.4004 | 61



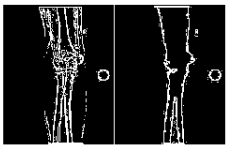
SAUVOLA | 0.019108 | [7 x 7]



NIBLACK | 0.018049 | [7 x 7]



BERSEN | 0.0229 | [7 x 7]



../images/imagen2.png

OTSU | 11.3601 | 92

KAPPUR | 11.1185 | 73

ISODATA | 11.2524 | 55

SAUVOLA | 0.075569 | [3 x 3]

NIBLACK | 0.084977 | [3 x 3]

BERSEN | 0.11359 | [3 x 3]

../images/imagen2.png

OTSU | 11.3601 | 92

KAPPUR | 11.1185 | 73

ISODATA | 11.2524 | 55

SAUVOLA | 0.076762 | [5 x 5]NIBLACK | 0.074448 | [5 x 5] BERSEN | 0.10424 | [5 x 5]

../images/imagen2.png

OTSU | 11.3601 | 92

KAPPUR | 11.1185 | 73

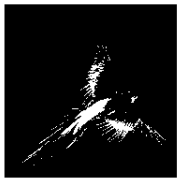
ISODATA | 11.2524 | 55

SAUVOLA | 0.074156 | [7 x 7]NIBLACK | 0.076883 | [7 x 7] BERSEN | 0.12204 | [7 x 7]

../images/parrot.png

OTSU | 5.4431 | 86

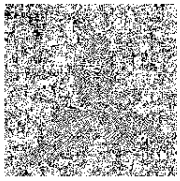
KAPPUR | 5.6717 | 140



ISODATA | 5.5797 | 35

SAUVOLA | 0.034061 | [3 x 3]

NIBLACK | 0.036797 | [3 x 3]

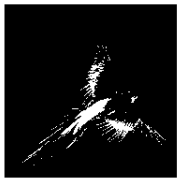


BERSEN | 0.048863 | [3 x 3]

../images/parrot.png

OTSU | 5.4431 | 86

KAPPUR | 5.6717 | 140

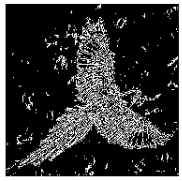


ISODATA | 5.5797 | 35

SAUVOLA | 0.035671 | [5 x 5]

NIBLACK | 0.036885 | [5 x 5]

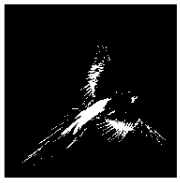
BERSEN | 0.04575 | [5 x 5]



../images/parrot.png

OTSU | 5.4431 | 86

KAPPUR | 5.6717 | 140

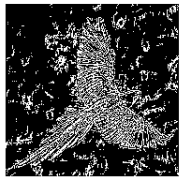


ISODATA | 5.5797 | 35

SAUVOLA | 0.035762 | [7 x 7]

NIBLACK | 0.035373 | [7 x 7]

BERSEN | 0.046911 | [7 x 7]



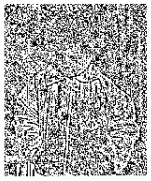
../images/pout.png

OTSU | 1.4185 | 147

KAPPUR | 1.3071 | 190

ISODATA | 1.5631 | 128

SAUVOLA | 0.0079379 | [3 x 3]NIBLACK | 0.007436 | [3 x 3]BERSEN | 0.0074971 | [3 x 3]



../images/pout.png

OTSU | 1.4185 | 147

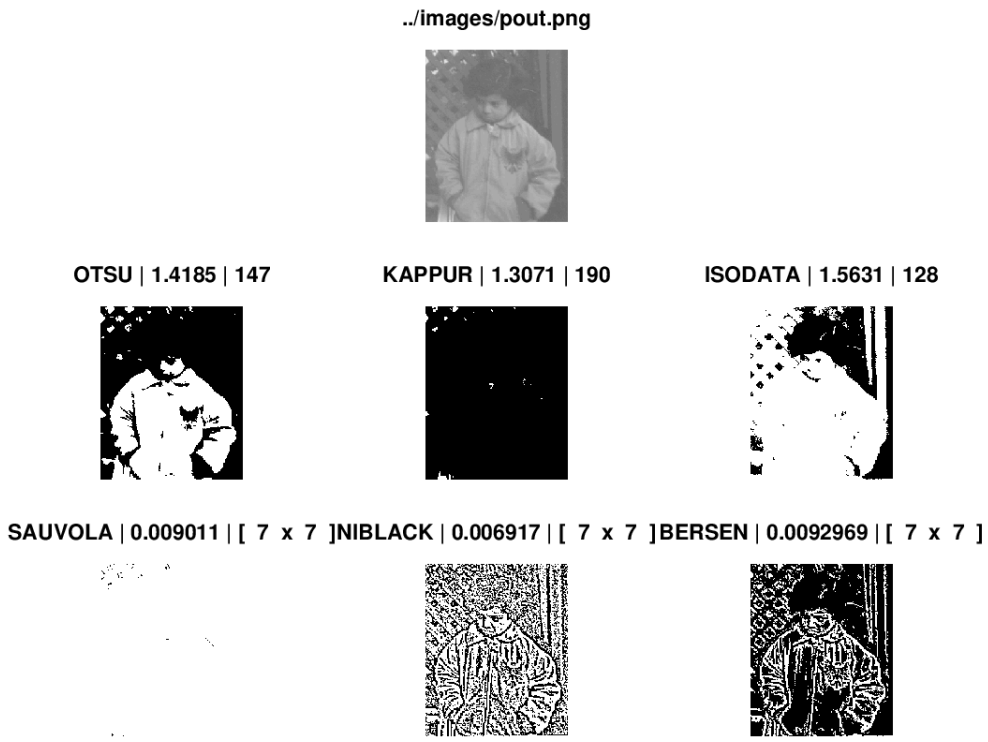
KAPPUR | 1.3071 | 190

ISODATA | 1.5631 | 128

SAUVOLA | 0.0080431 | [5 x 5]

NIBLACK | 0.0076411 | [5 x 5]

BERSEN | 0.007612 | [5 x 5]



1.3.2 Tiempo de Ejecucion

Consideracion Importante: Los metodos Locales usan un metodo de aplicacion de mascaras optimizado, que es aproximadamente 100 - 150 veces mas rapido que una aplicacion sin optimizar **(vectorizacion vs iteracion)**. Por esto se mostrara los promedios ajustando los resultados en un factor de 150.

[1]:
```
import pandas as pd
tiempos = pd.read_csv("./reformated_times.csv")
```

[2]:
```
tiempos
```

[2]:

	Kappur	Isodata	Metodos Locales	Sauvola_3	\
boat.png	3.808323	3.893524	3.947881	0.026556	
cameraman.png	3.720270	3.820893	3.830758	0.022484	
coins.png	1.325950	1.452557	1.535939	0.007651	
hands1.png	1.410065	1.336040	1.534092	0.007687	
house.png	3.813320	3.853636	3.728875	0.022547	
imagen1.png	3.001785	3.367783	3.400379	0.017977	
imagen2.png	11.360102	11.118505	11.252404	0.075569	
parrot.png	5.443084	5.671735	5.579687	0.034061	
pout.png	1.418503	1.307078	1.563069	0.007938	
westconcordorthophoto.png	2.366341	2.516025	2.573295	0.015854	

	Niblack_3	Bernsen_3	Sauvola_5	Niblack_5	\
boat.png	0.025161	0.031063	0.025224	0.027104	
cameraman.png	0.022725	0.029315	0.022946	0.023283	
coins.png	0.006907	0.006869	0.009208	0.007701	
hands1.png	0.006602	0.007381	0.009025	0.007200	
house.png	0.022598	0.031157	0.026755	0.021169	
imagen1.png	0.017537	0.021567	0.018875	0.017756	
imagen2.png	0.084977	0.113590	0.076762	0.074448	
parrot.png	0.036797	0.048863	0.035671	0.036885	
pout.png	0.007436	0.007497	0.008043	0.007641	
westconcordorthophoto.png	0.014135	0.021791	0.014378	0.012897	

	Bernsen_5	Sauvola_7	Niblack_7	Bernsen_7
boat.png	0.031446	0.026600	0.026298	0.038094
cameraman.png	0.033072	0.024921	0.023973	0.033302
coins.png	0.009148	0.008888	0.007458	0.009493
hands1.png	0.008103	0.008125	0.007035	0.009155
house.png	0.027384	0.025350	0.024018	0.026717
imagen1.png	0.021880	0.019108	0.018049	0.022900
imagen2.png	0.104241	0.074156	0.076883	0.122039
parrot.png	0.045750	0.035762	0.035373	0.046911
pout.png	0.007612	0.009011	0.006917	0.009297
westconcordorthophoto.png	0.017005	0.015118	0.013212	0.017844

Tiempos Promedio (sin ajuste)

[3]:
```
tiempos.mean()
```

[3]:
```
Kappur             3.766774
Isodata            3.833778
Metodos Locales    3.894638
Sauvola_3          0.023832
Niblack_3          0.024487
Bernsen_3          0.031909
Sauvola_5          0.024689
Niblack_5          0.023608
Bernsen_5          0.030564
Sauvola_7          0.024704
Niblack_7          0.023922
Bernsen_7          0.033575
dtype: float64
```

Tiempos Promedio (con ajuste)

[4]:
```
from copy import copy as copy
tiempos_ajuste = copy(tiempos)
tiempos_ajuste[tiempos_ajuste.columns[3:]] *= 150
```

```
tiempos_ajuste.mean()
```

[4]:
```
Kappur              3.766774
Isodata             3.833778
Metodos Locales     3.894638
Sauvola_3           3.574855
Niblack_3           3.673121
Bernsen_3           4.786402
Sauvola_5           3.703308
Niblack_5           3.541260
Bernsen_5           4.584621
Sauvola_7           3.705586
Niblack_7           3.588241
Bernsen_7           5.036277
dtype: float64
```

1.3.3 Discucion de Resultados

Es importante notar en las images resultado, que los metodos gloables , son exelentes para segmentar informacion de manera general, resaltando detalles (como en coins , que se resalta el volumen de los bordes) o marcando niveles en la escena (como en cameraman, donde los metodos gloables separan al individuo del fondo).

Sin embargo, metodos locales son mas eficientes con escenas donde existen multiples objetos pero bien diferenciados, con iluminacion uniforme y buena densidad de pixeles por imagen (como en pout, usando niblack).

Si bien cada metodo tiene su eficiencia computacional, debemos ver los resultados y no solo el tiempo, pues muchos metodos, como el isodata, son redudantes pero en algunos casos dan resultados excelentes (considerece la imagen2)

1.4 Referencias

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[ ]: