**מטלה 1**

GrabCut

לצורך ניתוח הביצועים של האלגוריתם, לכל תמונה ביצענו מספר נסיונות של grabcut עם מספר שונה של components. בכל טבלה אנחנו מציגים את הדיוק ואת מספר האיטרציות שלקחו כדי להגיע להתכנסות.

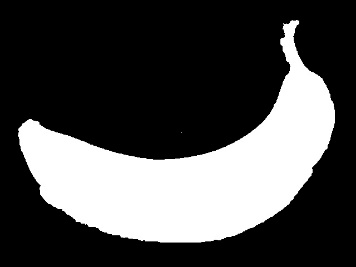
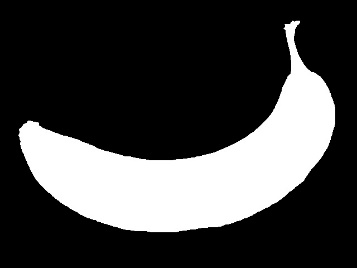
את ההתכנסות בדקנו לפי השינוי בגודל החתך המינימלי שנמצא באיטרציה הנוכחית והקודמת.

בכל טבלה אנחנו מציגים את התמונה המקורית, את gt\_mask, את הmask שהתקבל מהאלגוריתם ואת התמונה לאחר החיתוך.

להלן הממצאים:

Banana1

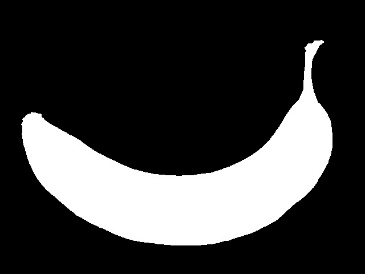
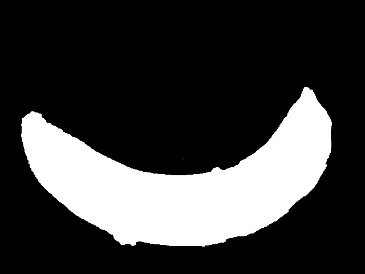
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.963919 | 0.87653 | 40.2071722 | 5 |
| 3 | 0.652454 | 0.424305 | 33.9286468 | 3 |
| 4 | 0.655153 | 0.426183 | 35.7755206 | 3 |
| 5 | 0.66165 | 0.430869 | 35.7854905 | 3 |

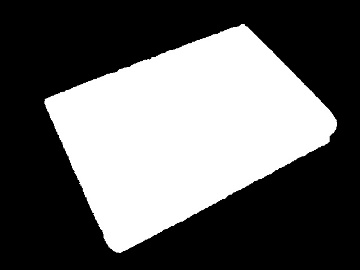


Best result (2 comps)

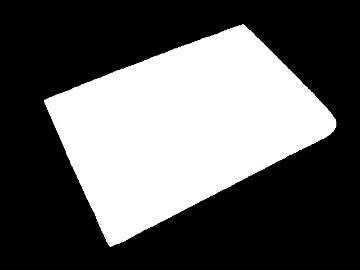
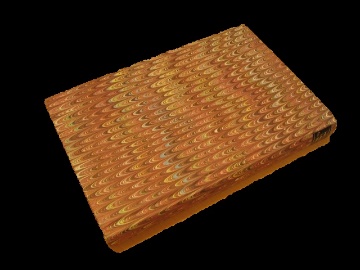
Banana2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.990173 | 0.959079 | 18.3634629 | 3 |
| 3 | 0.990238 | 0.959352 | 18.0833318 | 3 |
| 4 | 0.990182 | 0.959127 | 19.5851643 | 3 |
| 5 | 0.990156 | 0.959026 | 19.4580393 | 3 |



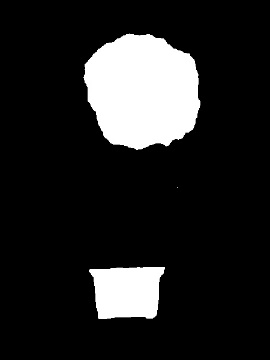
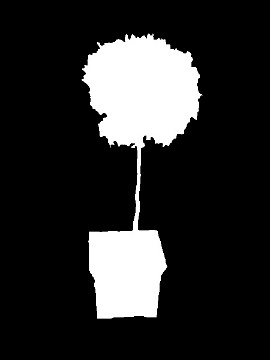
Book

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.970368 | 0.925753 | 27.9893446 | 3 |
| 3 | 0.978219 | 0.944319 | 41.7404382 | 4 |
| 4 | 0.960459 | 0.903312 | 56.6367497 | 4 |
| 5 | 0.960423 | 0.903232 | 71.375005 | 5 |



Bush

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.960756 | 0.774807 | 9.21730685 | 3 |
| 3 | 0.85047 | 0.528237 | 11.2476015 | 3 |
| 4 | 0.852504 | 0.532269 | 11.66135 | 3 |
| 5 | 0.861156 | 0.547252 | 12.2629261 | 3 |



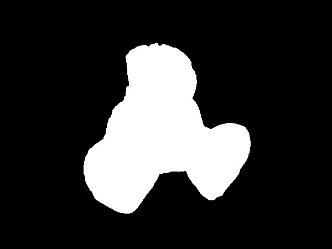
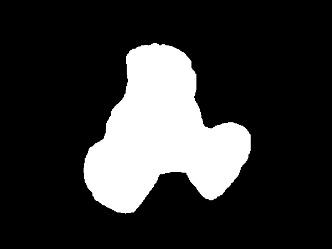
Cross

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.637844 | 0.451719 | 52.6769357 | 5 |
| 3 | 0.692007 | 0.543872 | 65.6095619 | 5 |
| 4 | 0.522022 | 0.375709 | 55.8603053 | 5 |
| 5 | 0.552904 | 0.392648 | 61.6979246 | 5 |



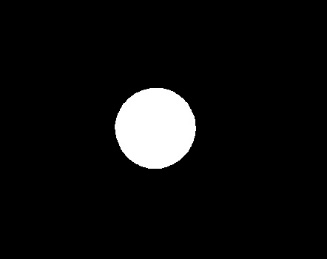
Flower

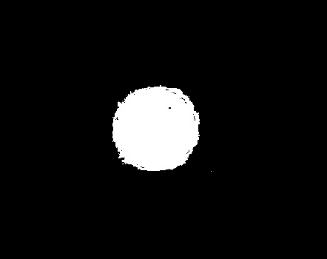
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.996911 | 0.984268 | 13.9195294 | 3 |
| 3 | 0.996552 | 0.982473 | 12.7245612 | 3 |
| 4 | 0.996867 | 0.984038 | 13.4905825 | 3 |
| 5 | 0.996515 | 0.982285 | 13.2505083 | 3 |



Foolmoon

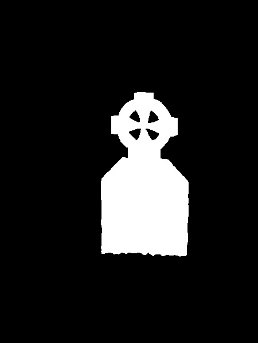
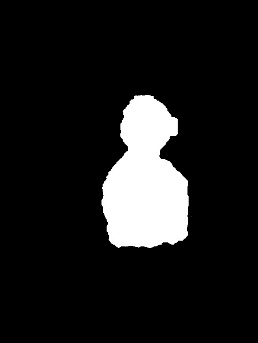
|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.992075 | 0.883593 | 2.76309514 | 2 |
| 3 | 0.990659 | 0.865394 | 1.49433827 | 1 |
| 4 | 0.990478 | 0.863104 | 1.48438025 | 1 |
| 5 | 0.989703 | 0.853625 | 1.49133754 | 1 |





Grave

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.979344 | 0.833124 | 6.98641181 | 3 |
| 3 | 0.971941 | 0.802785 | 2.76258755 | 1 |
| 4 | 0.972463 | 0.808099 | 2.68614435 | 1 |
| 5 | 0.963678 | 0.762058 | 2.87848639 | 1 |



Llama

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.992276 | 0.956615 | 11.67832 | 4 |
| 3 | 0.992234 | 0.956378 | 11.94045 | 4 |
| 4 | 0.992103 | 0.955675 | 12.2609 | 4 |
| 5 | 0.991824 | 0.953872 | 12.23672 | 4 |

A white goat with its mouth open

Description automatically generated with low confidenceA picture containing nature, cave, silhouette

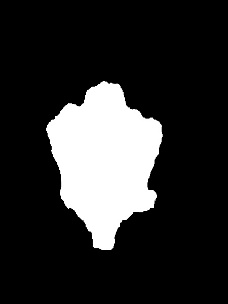
Description automatically generatedA picture containing silhouette

Description automatically generatedA picture containing outdoor, mammal, mountain, ground

Description automatically generated

Memorial

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.985744 | 0.924193 | 12.31882 | 3 |
| 3 | 0.982711 | 0.908264 | 11.5946 | 3 |
| 4 | 0.982785 | 0.908407 | 11.27813 | 3 |
| 5 | 0.982767 | 0.908308 | 11.51209 | 3 |



Sheep

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.996237 | 0.932366 | 8.83454 | 3 |
| 3 | 0.996156 | 0.930712 | 8.799653 | 3 |
| 4 | 0.996248 | 0.932507 | 8.827176 | 3 |
| 5 | 0.996319 | 0.933418 | 7.339309 | 3 |

A sheep standing in a field

Description automatically generated with low confidenceA picture containing nature, cave, silhouette

Description automatically generatedA picture containing mammal, dark, silhouette, night sky

Description automatically generatedA bright light in the dark

Description automatically generated with low confidence

Stone2

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.996403 | 0.985333 | 21.50507 | 4 |
| 3 | 0.996937 | 0.987521 | 17.24794 | 3 |
| 4 | 0.996442 | 0.985489 | 17.75763 | 3 |
| 5 | 0.996292 | 0.984877 | 19.86552 | 3 |

A picture containing food, vegetable, dish, tomato

Description automatically generatedA picture containing silhouette

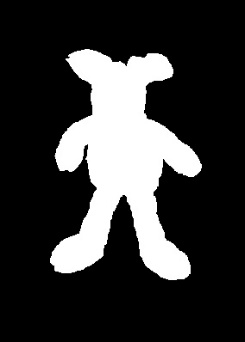
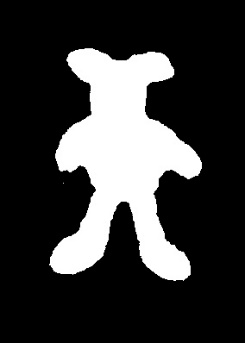
Description automatically generatedA picture containing dark, snack food

Description automatically generatedA close-up of a planet

Description automatically generated with low confidence

Teddy

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.989702 | 0.95381 | 3.44763 | 3 |
| 3 | 0.96831 | 0.870527 | 1.453652 | 1 |
| 4 | 0.968345 | 0.870653 | 1.490161 | 1 |
| 5 | 0.968354 | 0.870684 | 1.442408 | 1 |

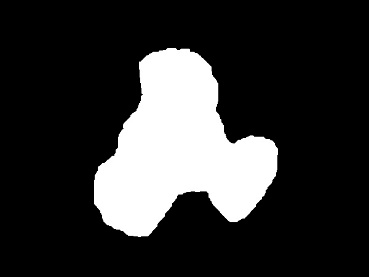
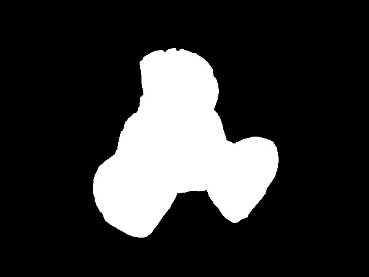
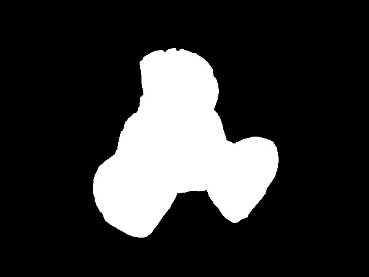
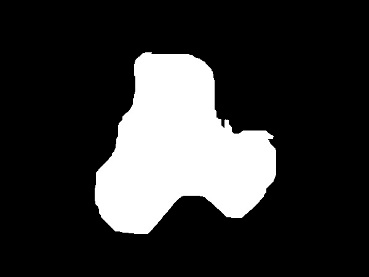
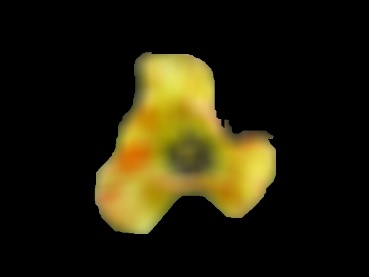


נשים לב שהרבה מהמקרים דווקא הגענו לתוצאות טובות יותר כאשר בחרנו מספר קטן של components. זה כנראה קורה בכלל הגיוון בצבעים שבתמונה. כלומר, אם יש בתמונה גיוון נמוך של צבעים (כמו בבננה) אז ריבוי של components 'מבלבל' את האלגוריתם ומחשיב רקע כחפץ.

נחקור את השוני באלגוריתם עם טשטוש. נבחר 4 תמונות עם ציונים טובים וגרועים:

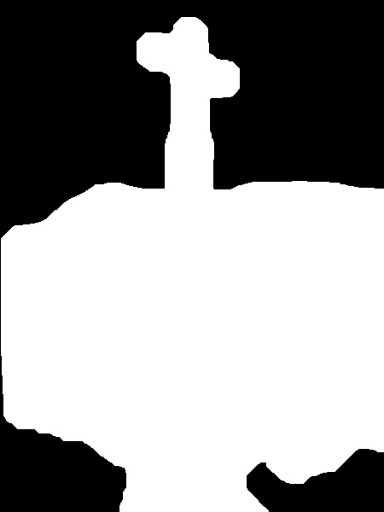
flower

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| blur | n components | accuracy | jac | time | iterations |
| low | 2 | 0.995756 | 0.978437 | 11.56142 | 3 |
| 3 | 0.995293 | 0.976135 | 11.31872 | 3 |
| 4 | 0.993963 | 0.969676 | 11.56404 | 3 |
| 5 | 0.994296 | 0.971314 | 11.19678 | 3 |
| high | 2 | 0.980904 | 0.907476 | 15.97028 | 3 |
| 3 | 0.976011 | 0.889189 | 16.70733 | 3 |
| 4 | 0.966685 | 0.85304 | 18.14367 | 3 |
| 5 | 0.963804 | 0.842528 | 18.21135 | 3 |



cross

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| blur | n components | accuracy | jac | time | iterations |
| low | 2 | 0.62857 | 0.44271 | 35.32364 | 5 |
| 3 | 0.676752 | 0.492935 | 55.82045 | 8 |
| 4 | 0.582226 | 0.460145 | 67.30054 | 7 |
| 5 | 0.52817 | 0.403547 | 44.4501 | 5 |
| high | 2 | 0.621756 | 0.437384 | 39.00756 | 5 |
| 3 | 0.498978 | 0.367062 | 51.95372 | 4 |
| 4 | 0.453937 | 0.333745 | 41.81197 | 4 |
| 5 | 0.554215 | 0.445543 | 52.5045 | 4 |

A statue in front of a building

Description automatically generated with medium confidenceA picture containing text, silhouette

Description automatically generatedA picture containing outdoor, sky, building, grass

Description automatically generated

A picture containing dark, snack food

Description automatically generatedA picture containing food, dish, vegetable, snack food

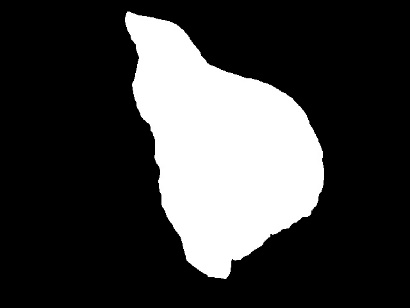
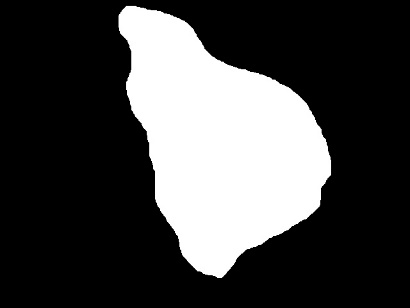
Description automatically generatedA picture containing silhouette

Description automatically generatedA picture containing silhouette, cave

Description automatically generatedStone

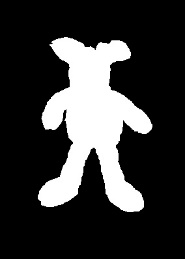
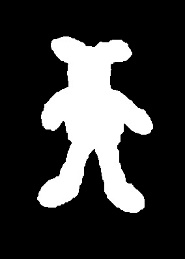
|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| blur | n components | accuracy | jac | time | iterations |
| low | 2 | 0.994792 | 0.978909 | 13.96381 | 5 |
| 3 | 0.994844 | 0.979114 | 11.50605 | 4 |
| 4 | 0.993988 | 0.975738 | 8.96239 | 3 |
| 5 | 0.994658 | 0.978384 | 9.588325 | 3 |
| high | 2 | 0.970882 | 0.892289 | 18.95662 | 7 |
| 3 | 0.969372 | 0.887601 | 16.71902 | 6 |
| 4 | 0.96821 | 0.883831 | 16.98043 | 6 |
| 5 | 0.951481 | 0.833117 | 14.16319 | 5 |





teddy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| blur | n components | accuracy | jac | time | iterations |
| low | 2 | 0.983465 | 0.92793 | 2.60201 | 3 |
| 3 | 0.986393 | 0.940095 | 1.890019 | 2 |
| 4 | 0.988039 | 0.94697 | 1.966767 | 2 |
| 5 | 0.987163 | 0.943278 | 2.015022 | 2 |
| high | 2 | 0.879724 | 0.639944 | 4.305809 | 3 |
| 3 | 0.878141 | 0.636924 | 4.585284 | 3 |
| 4 | 0.880821 | 0.642052 | 4.771945 | 3 |
| 5 | 0.878919 | 0.638405 | 4.811623 | 3 |



A close up of a finger

Description automatically generated with low confidenceIcon

Description automatically generatedA picture containing blur

Description automatically generatedA picture containing text, weapon

Description automatically generated

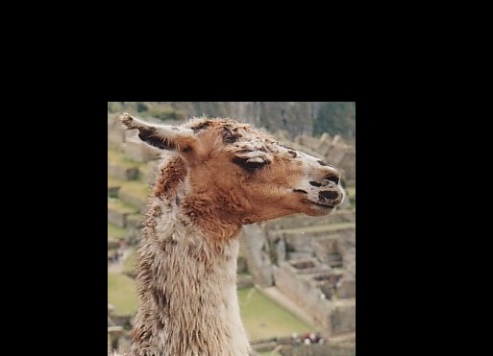
אנחנו לומדים מכך שטשטוש התמונה מגביל את האלגוריתם לזהות את ה'מסגרת' של החפץ. כלומר מסביב לאופייקט נראה יותר רקע מאשר ללא הטשטוש. זה ככל הנראה קורה כי ערכי הפיקסלים 'מתקרבים' אחד לשני בערכם בתהליך הטשטוש ומכך הקיבולות בקשתות הגרף מתקרוב אחת לשניה בערכן ולכן החתך פחות טוב. מקרה מעניין הוא ה cross כי עם טשטוש חלש האלגוריתם מזהה את מסגרת האובייקט בצורה כמעט מושלמת (כשלא עשה כך ללא הטשטוש). לא הצלחנו למצוא הסבר טוב לתופעה.

נחקור את שינוי המסגרת במספר תמונות:

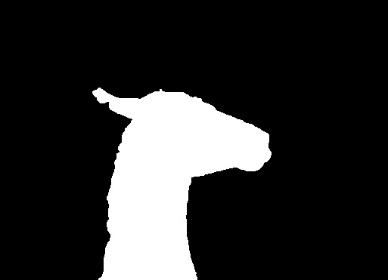
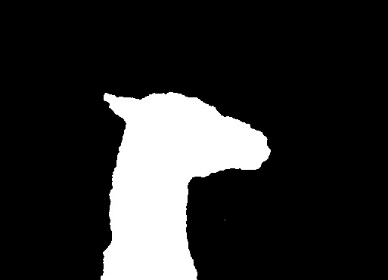
במקום לתת מסגרת מדויקת על האוביקט ניתן כמעט את כל התמונה

Llama

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.992292 | 0.956724 | 12.03568 | 4 |
| 3 | 0.992402 | 0.957325 | 12.45276 | 4 |
| 4 | 0.99245 | 0.957407 | 12.5943 | 4 |
| 5 | 0.985714 | 0.922885 | 6.802486 | 2 |



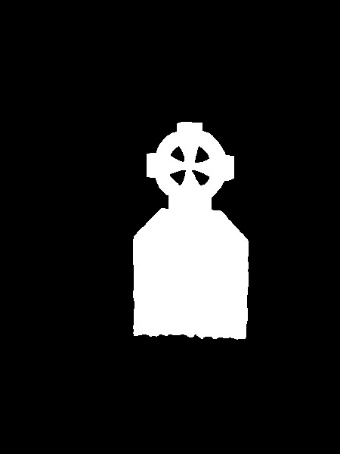
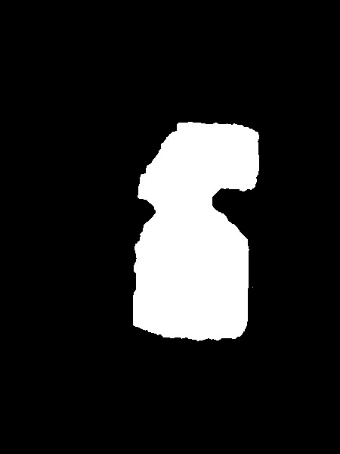
לפני: אחרי:



grave

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| n components | accuracy | jac | time | iterations |
| 2 | 0.964452 | 0.75013 | 4.92112 | 2 |
| 3 | 0.972733 | 0.810238 | 2.891633 | 1 |
| 4 | 0.972578 | 0.808904 | 2.831137 | 1 |
| 5 | 0.963819 | 0.762773 | 2.886675 | 1 |

לפני: אחרי:



הדיוק בקבר מעט נמוך יותר אבל בגדול נראה שהביצועים לא משתנים באופן משמעותי.