

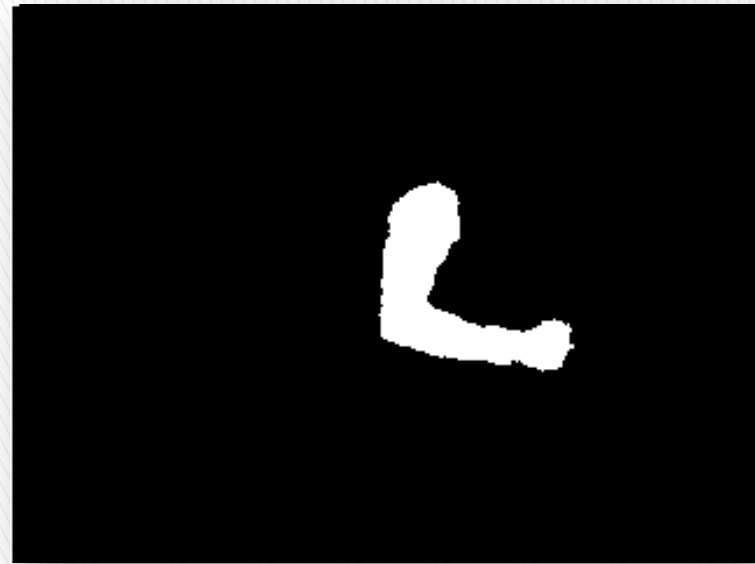
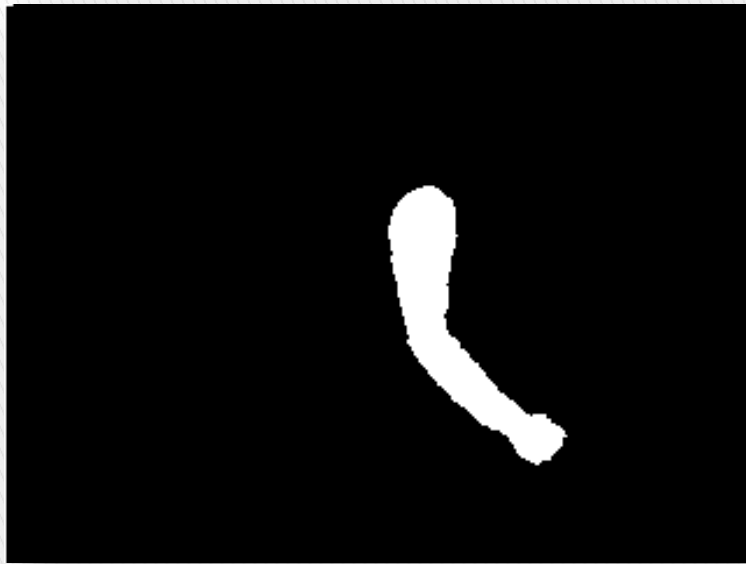
# Estudio de algoritmos para la estimación de la posición de un brazo a partir de su imagen.

EMNO 2015

David Darías Torres

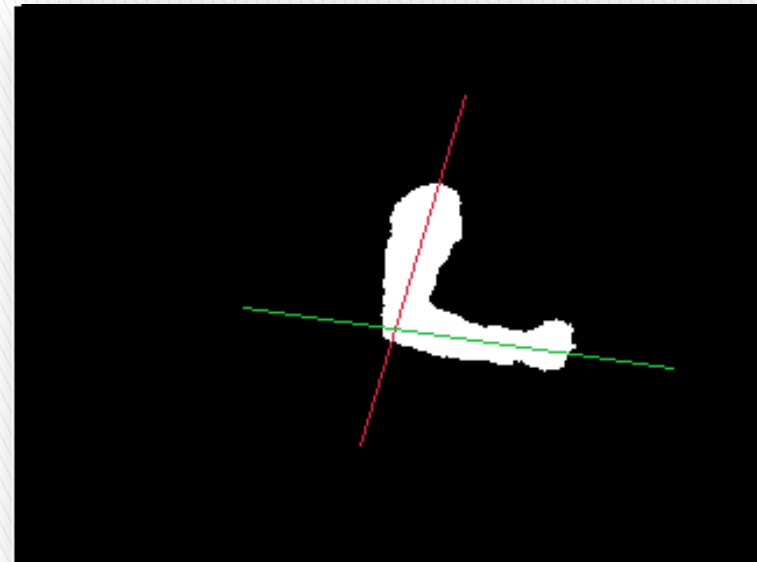
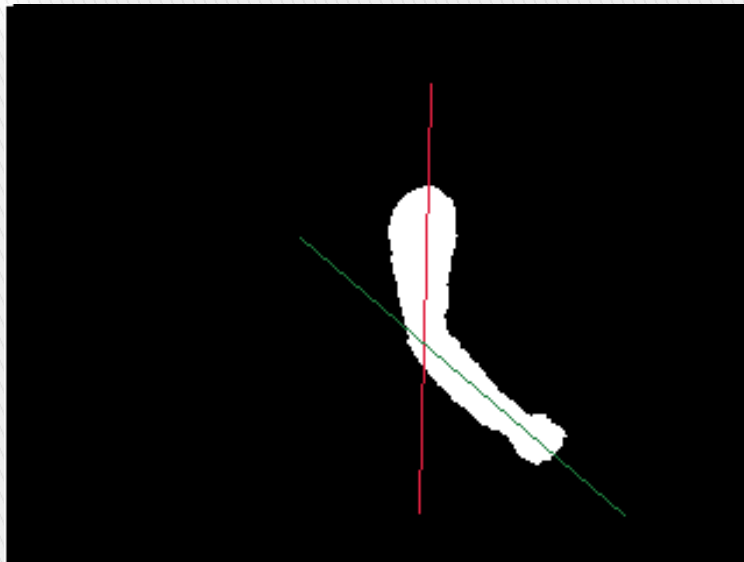
Claudia Paredes, David Darías, Ezequiel Balmori, José Javier Señaris  
Tutor: M.Sc. Oscar Luis Vera.

# Definición del problema



Entrada

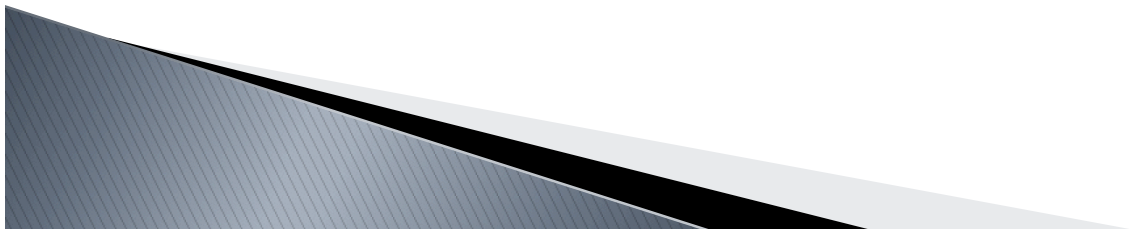
# Definición del problema



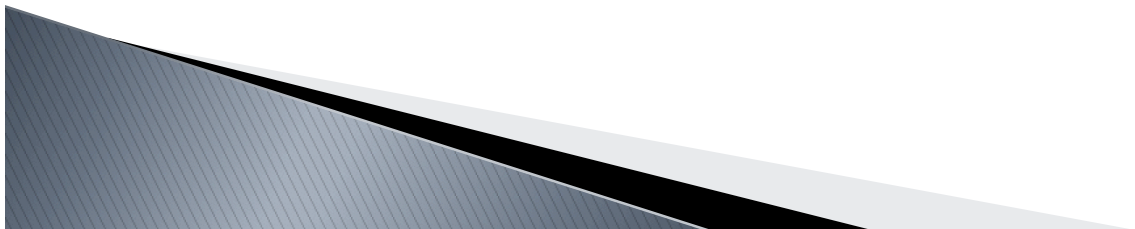
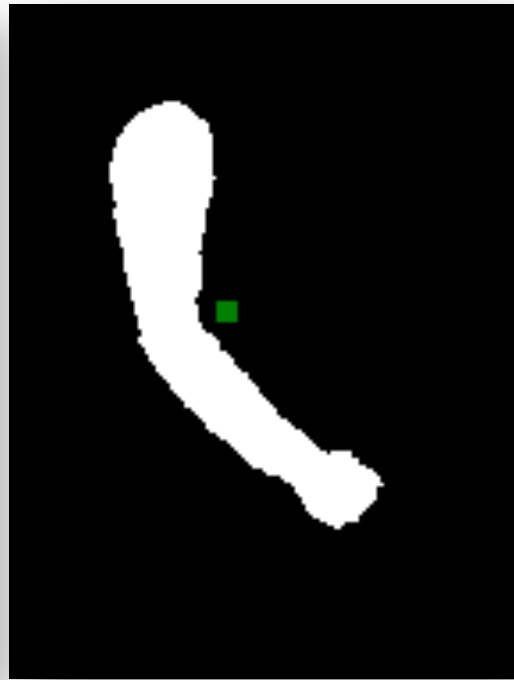
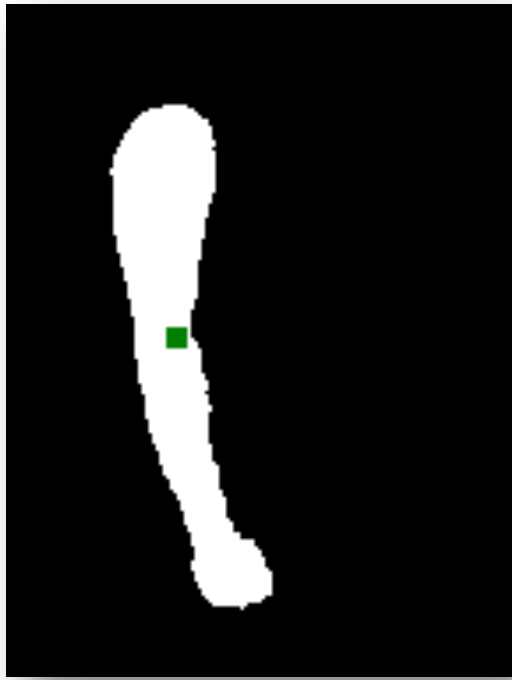
Salida

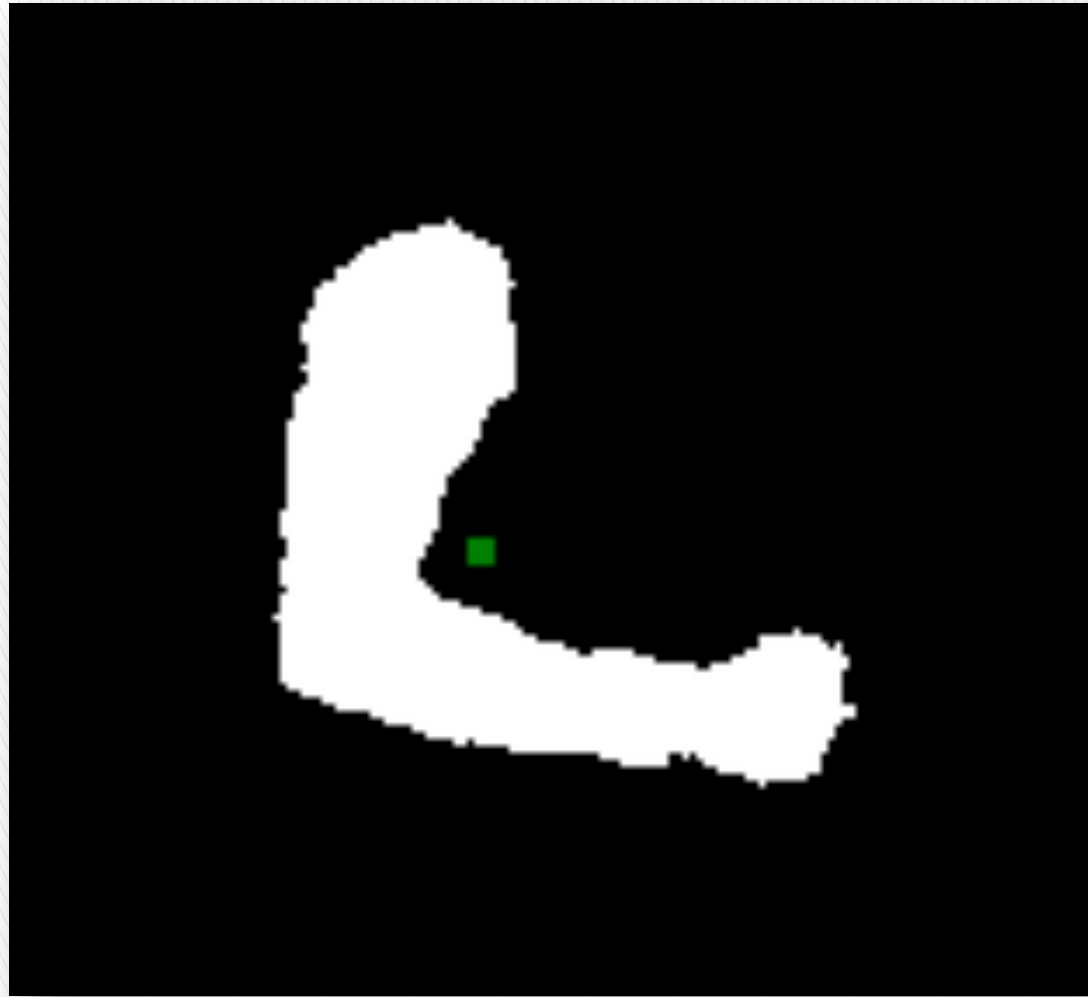
# Algoritmos implementados

- ▶ Heurística específica
- ▶ Metaheurística (Recocido Simulado)
- ▶ Simplex
- ▶ Gauss–Newton
- ▶ Levenberg–Marquardt



# Heurística específica

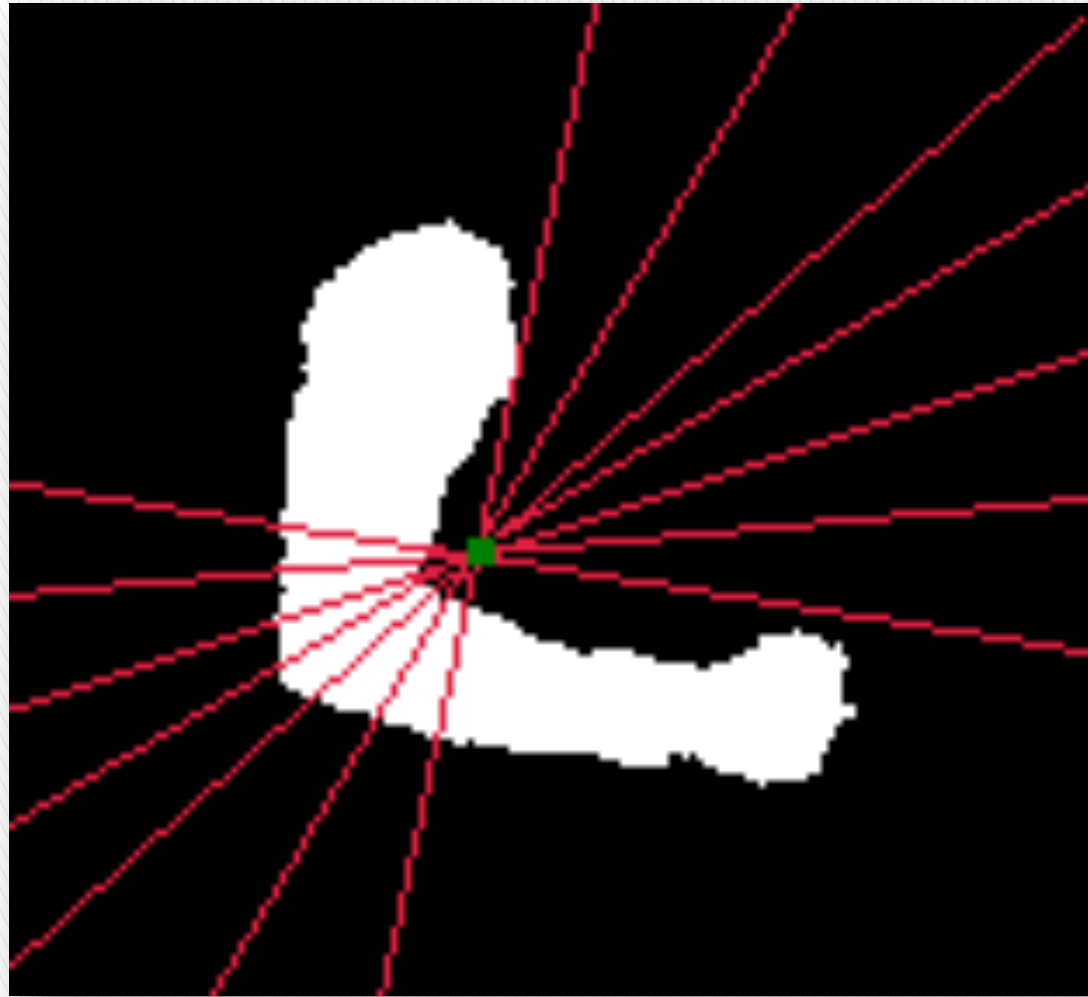




Algoritmo Heurístico

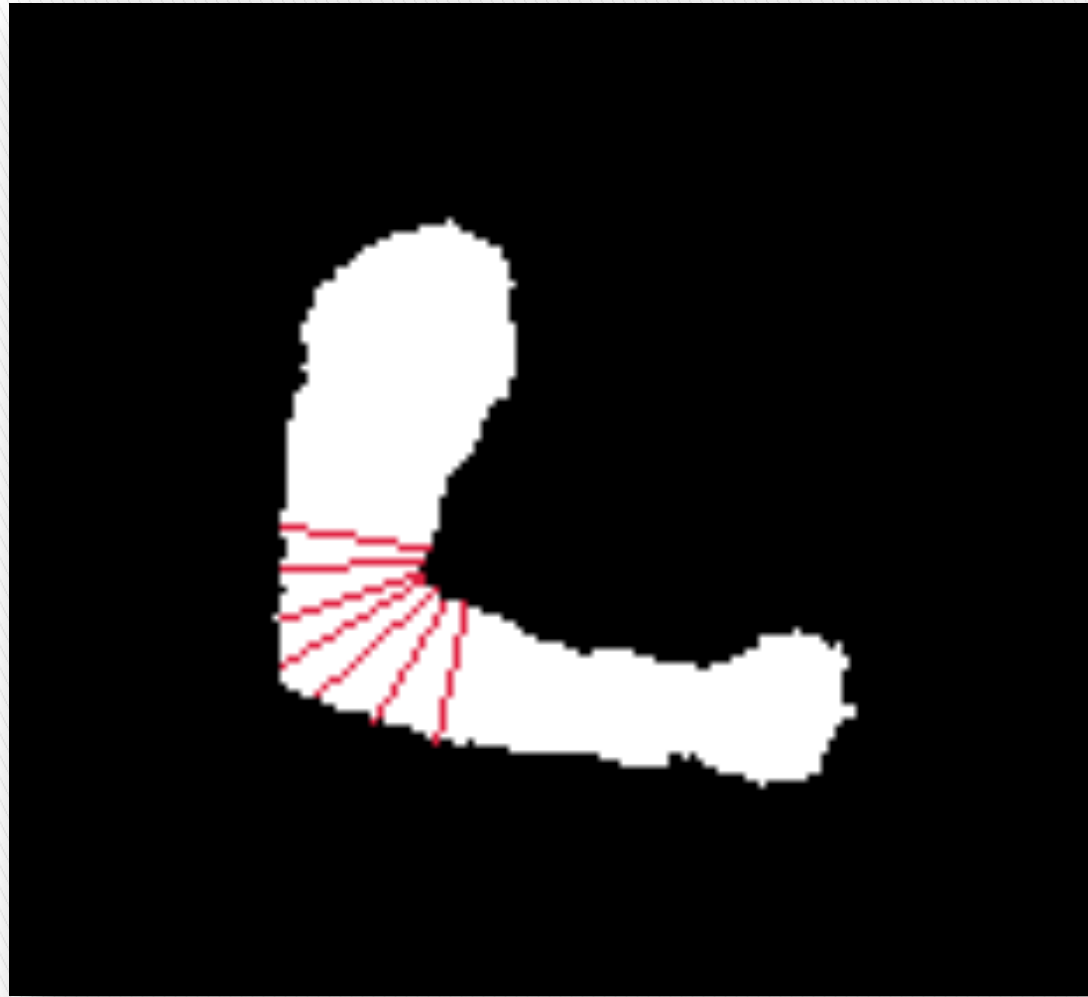


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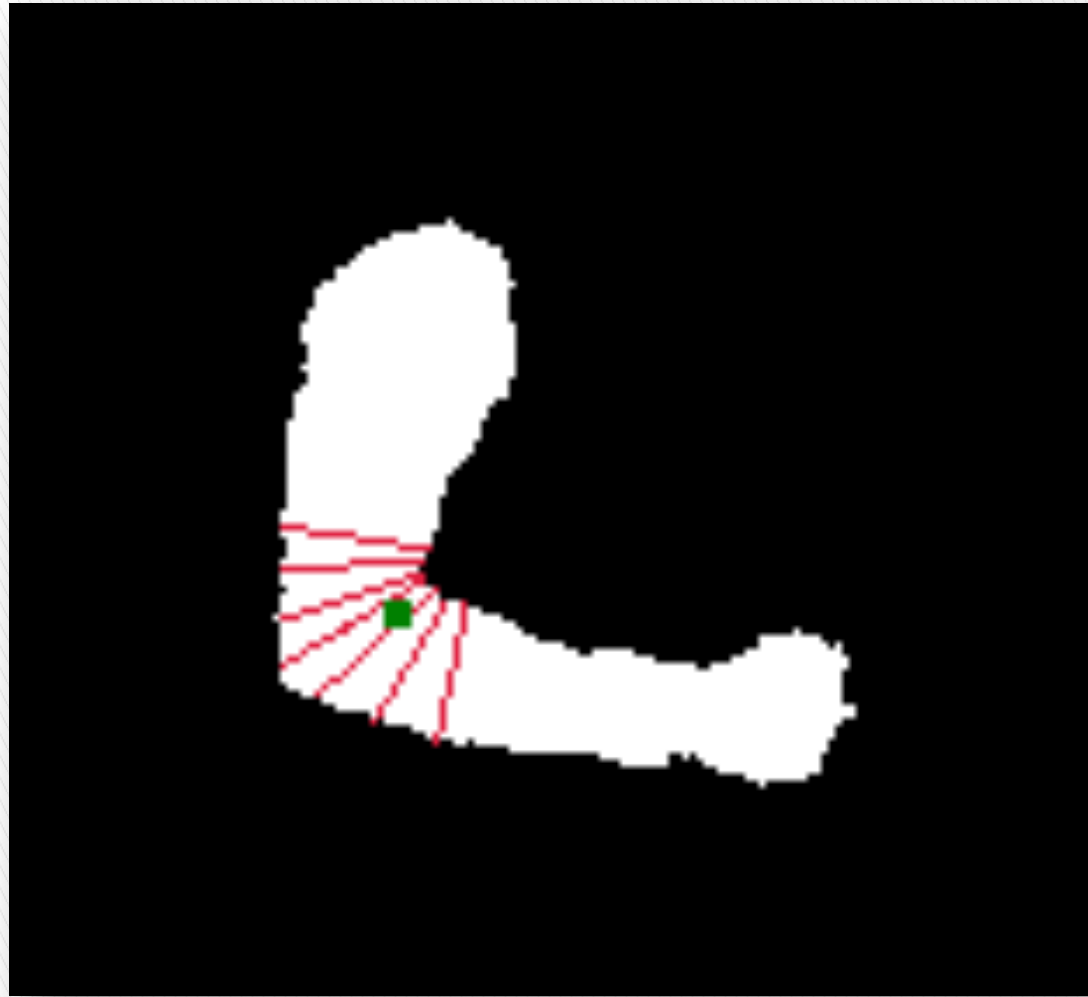


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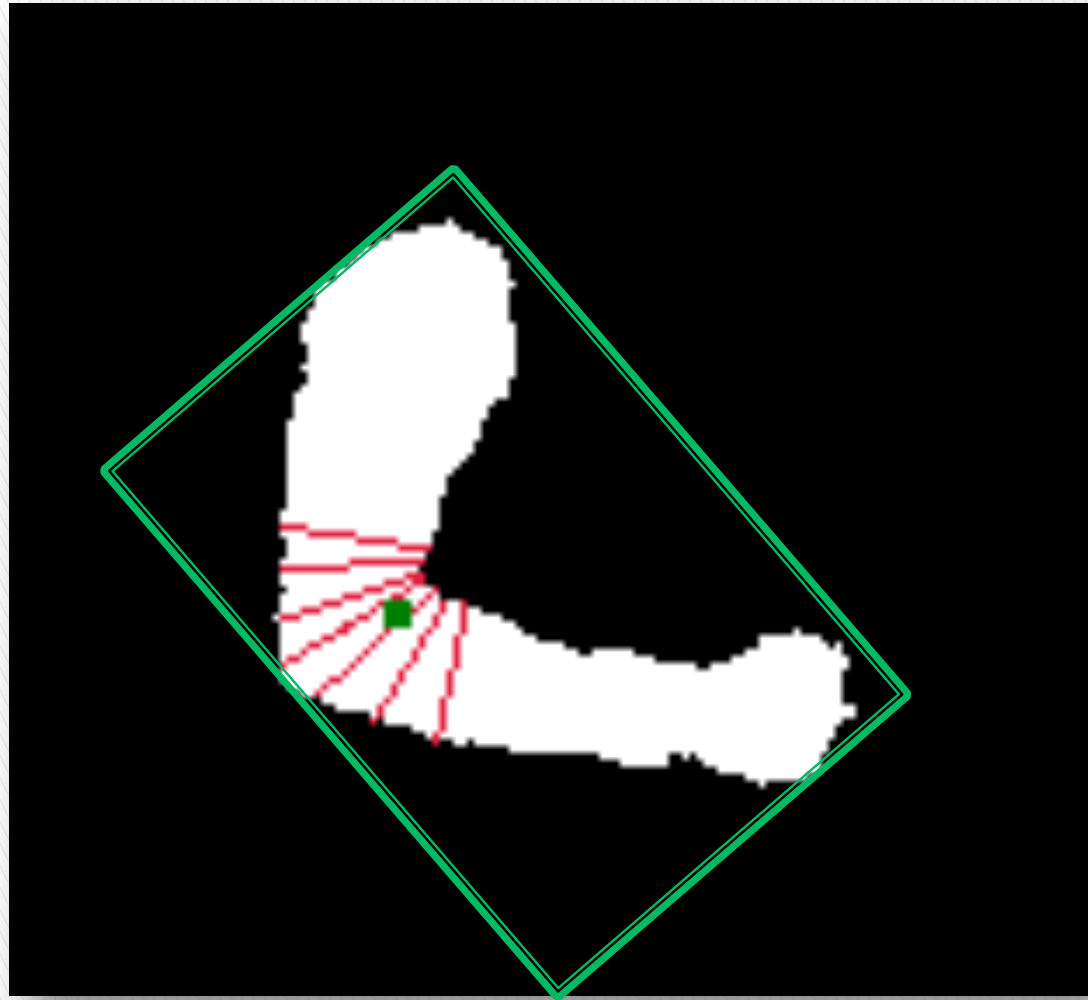




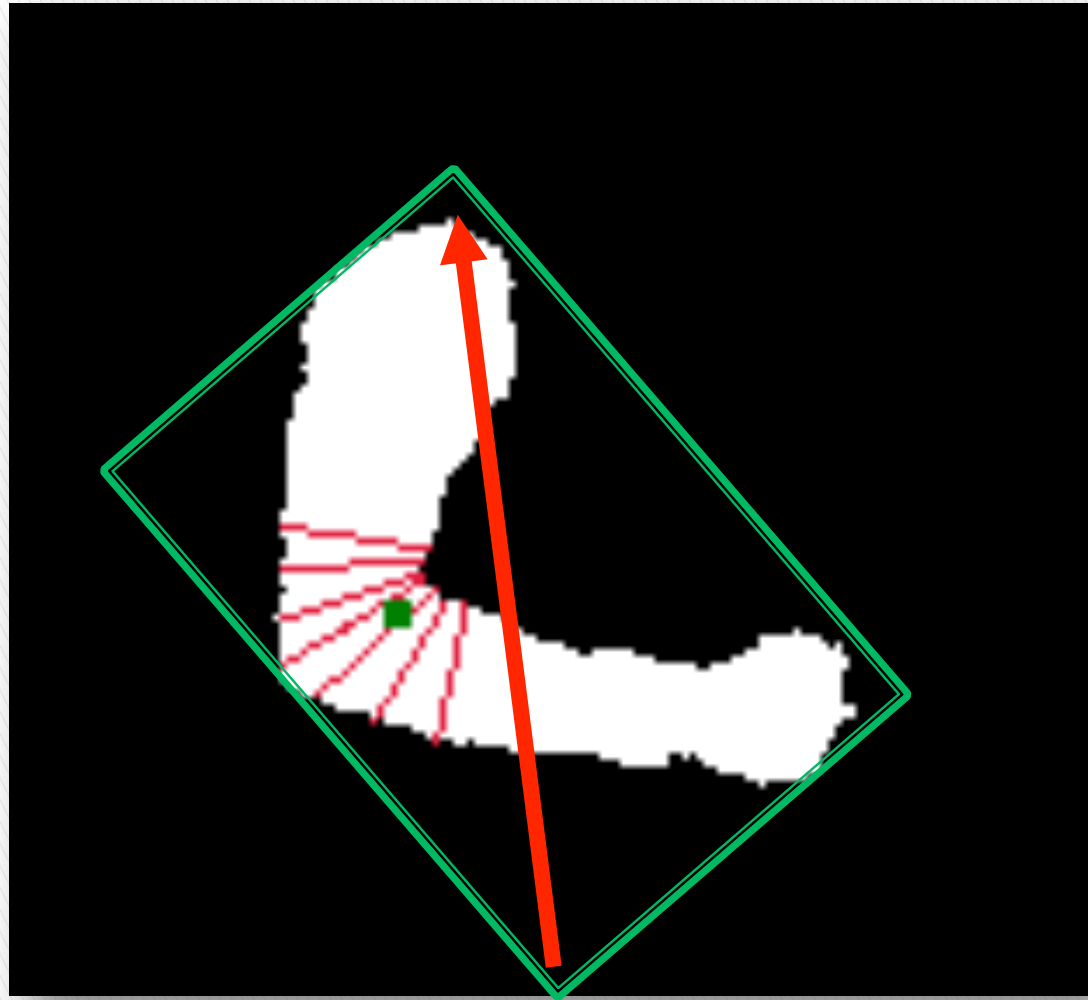
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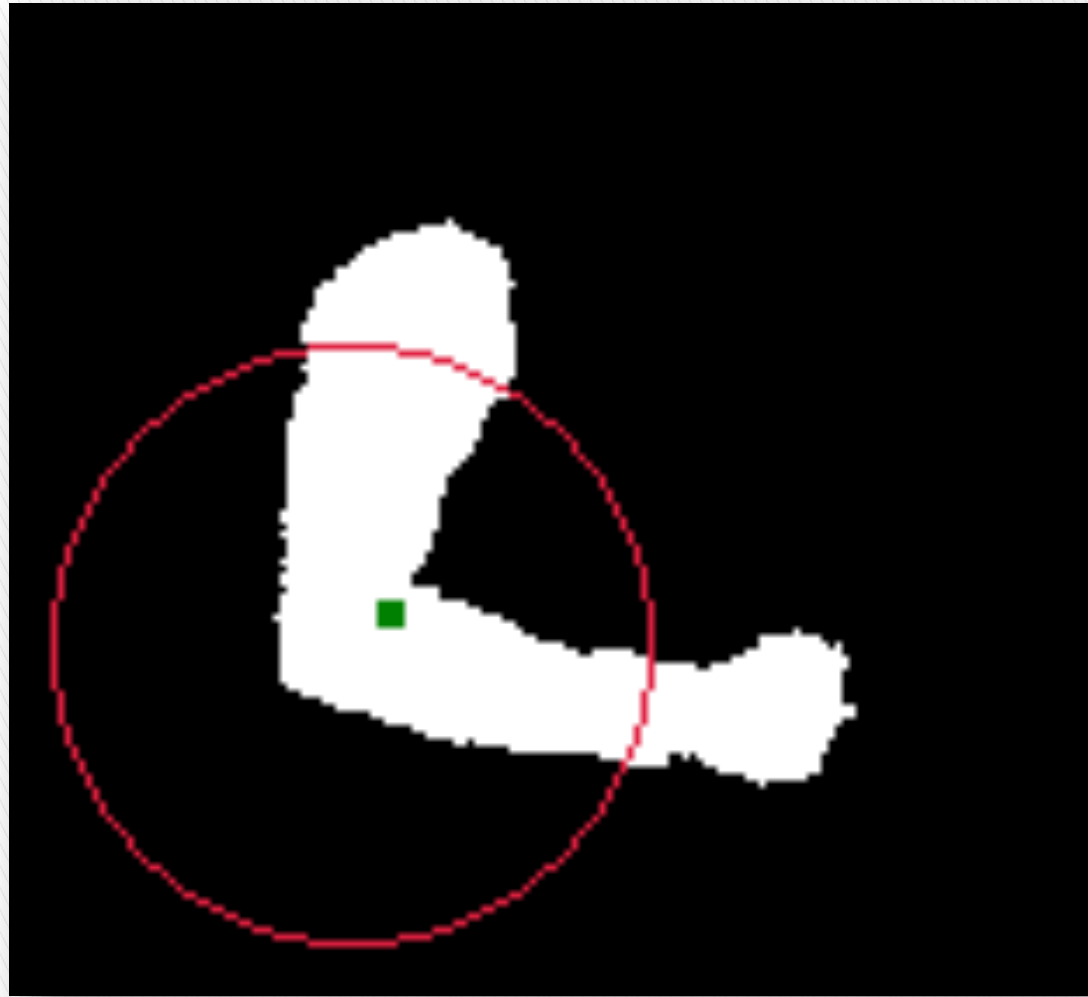
Algoritmo Heurístico



Algoritmo Heurístico



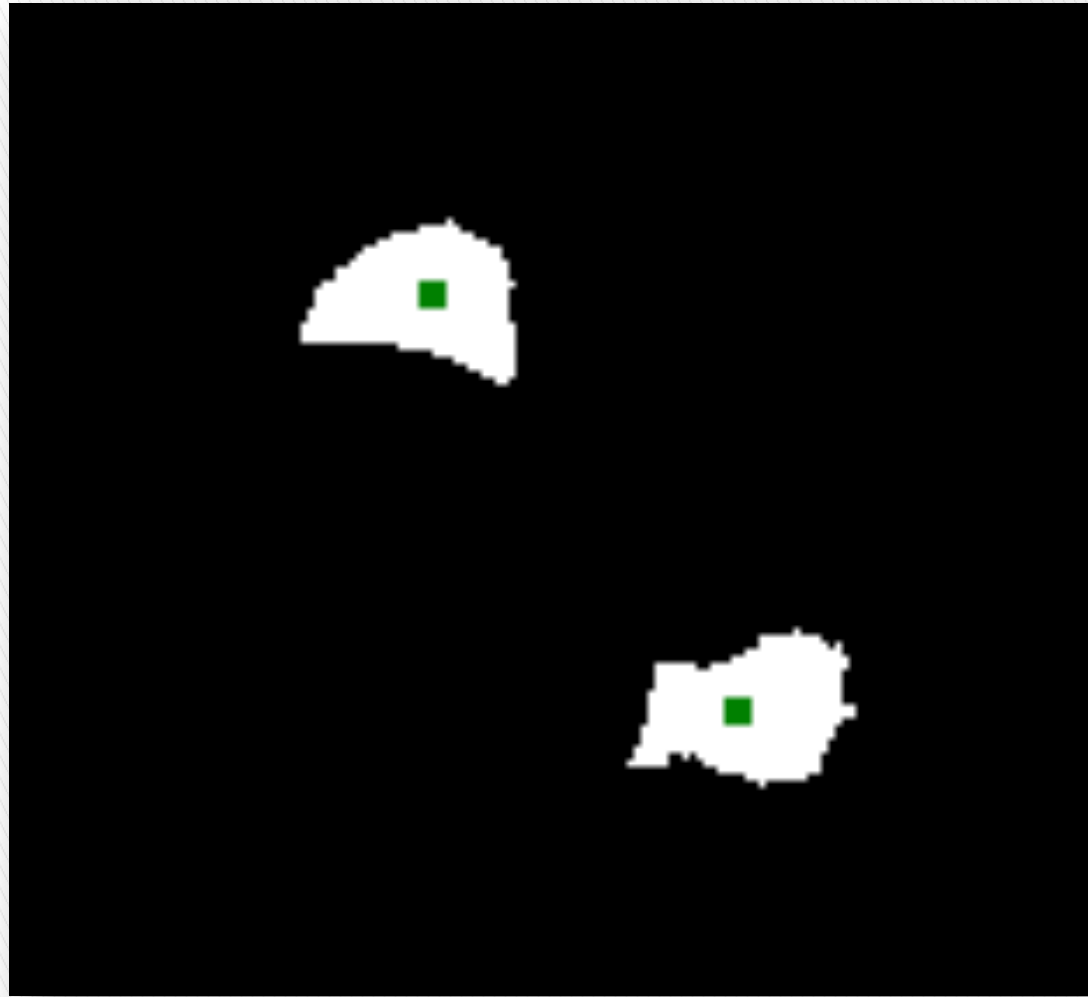
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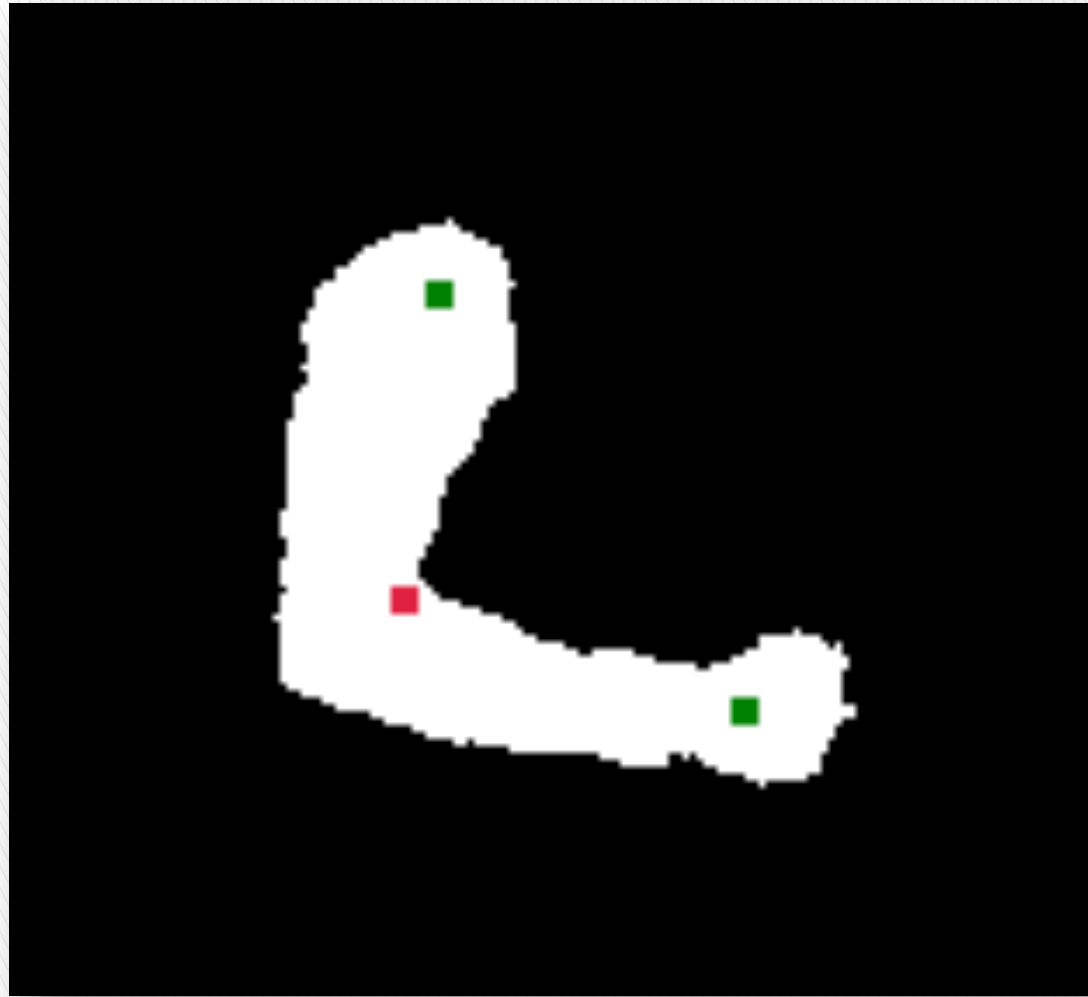
Algoritmo Heurístico



Algoritmo Heurístico

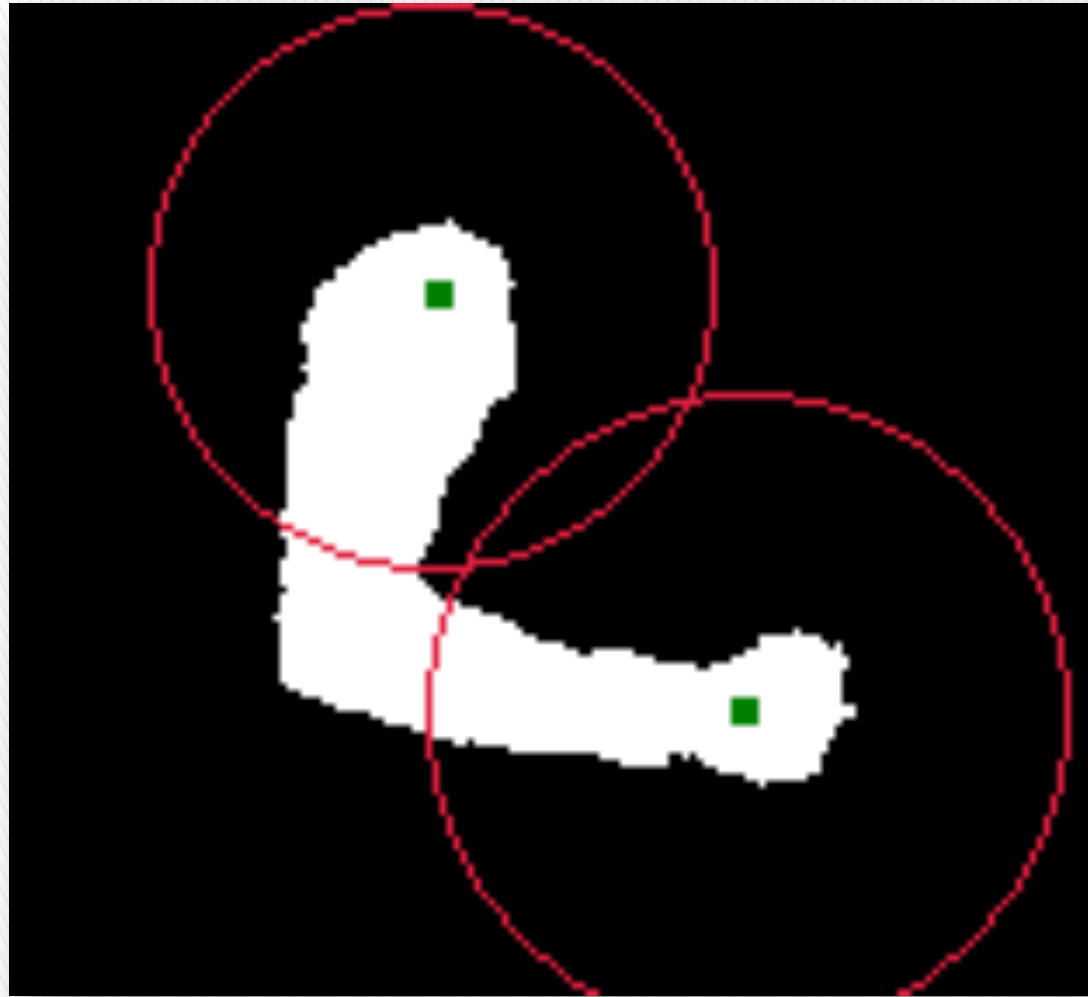


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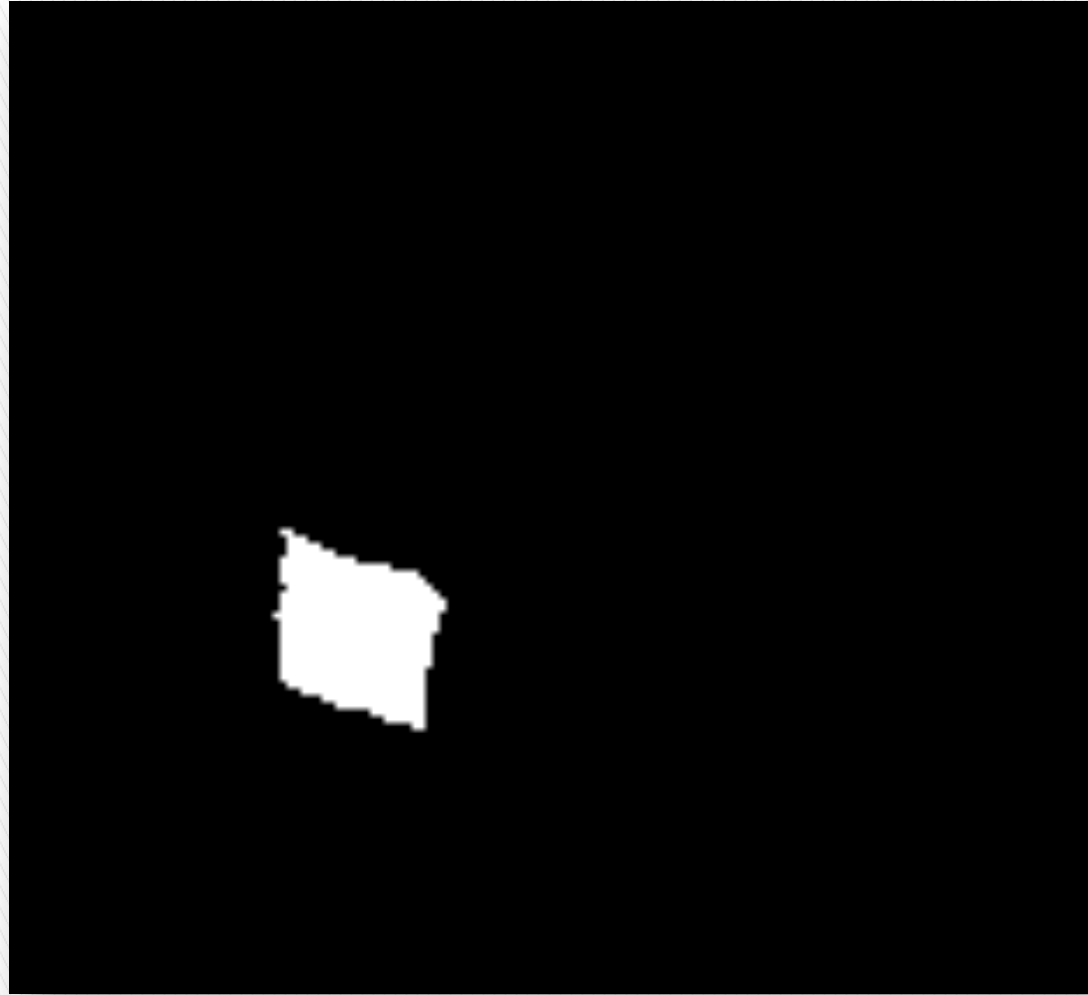


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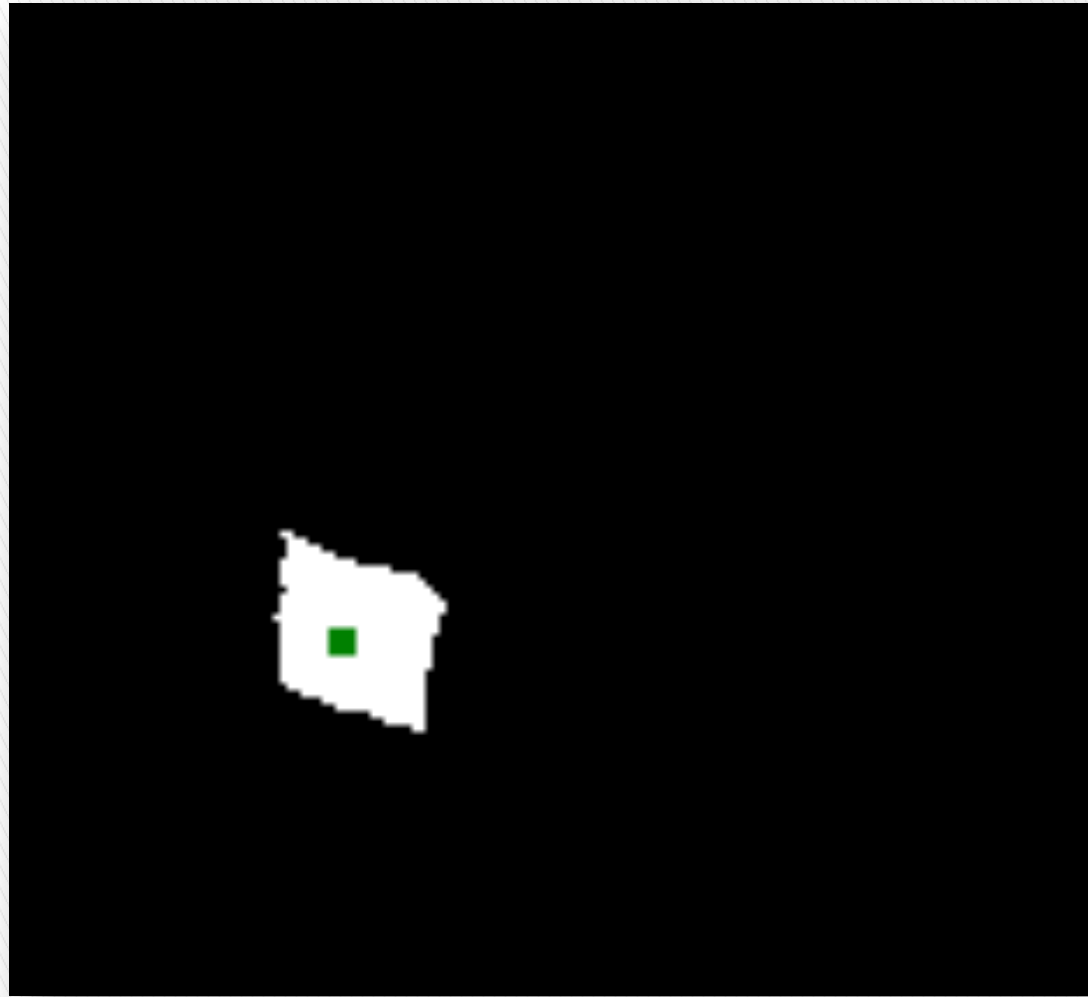




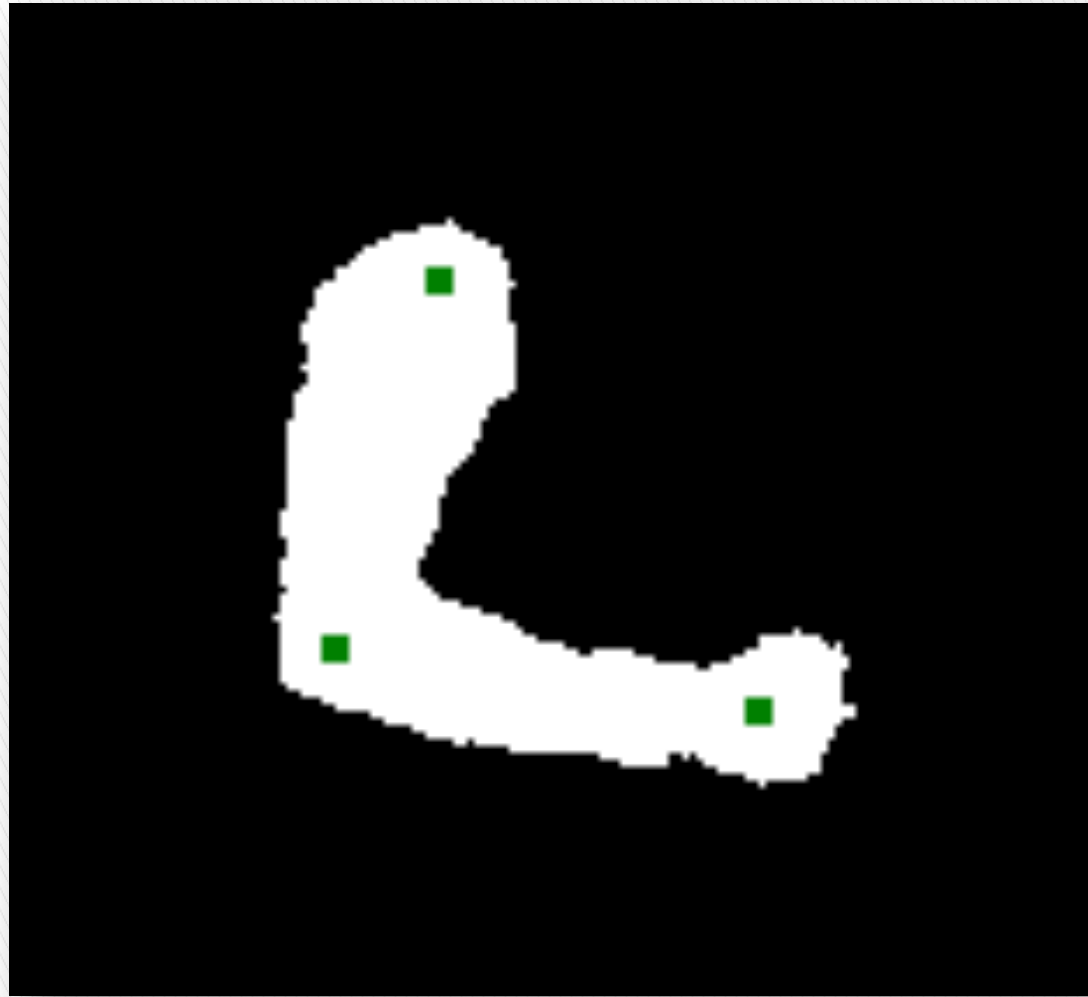
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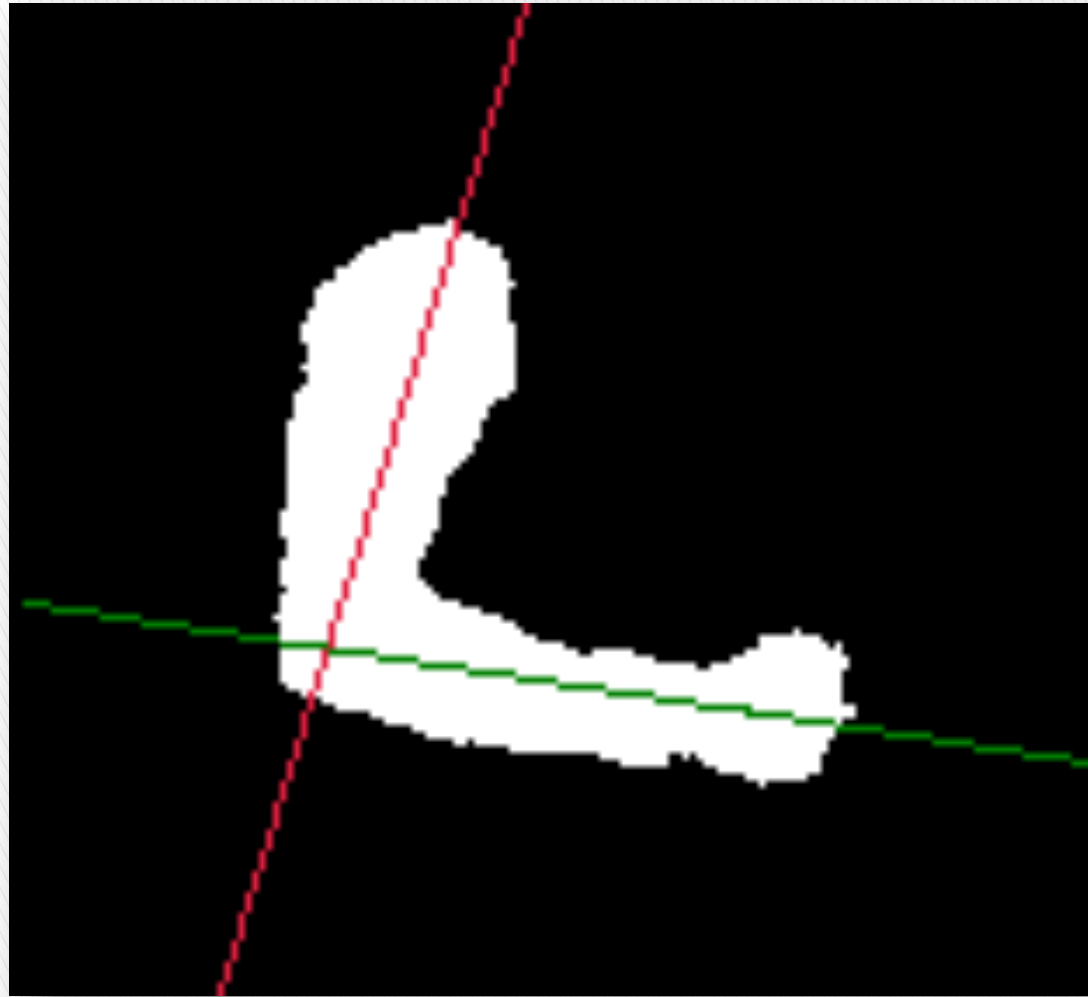
Algoritmo Heurístico



Algoritmo Heurístico



Algoritmo Heurístico

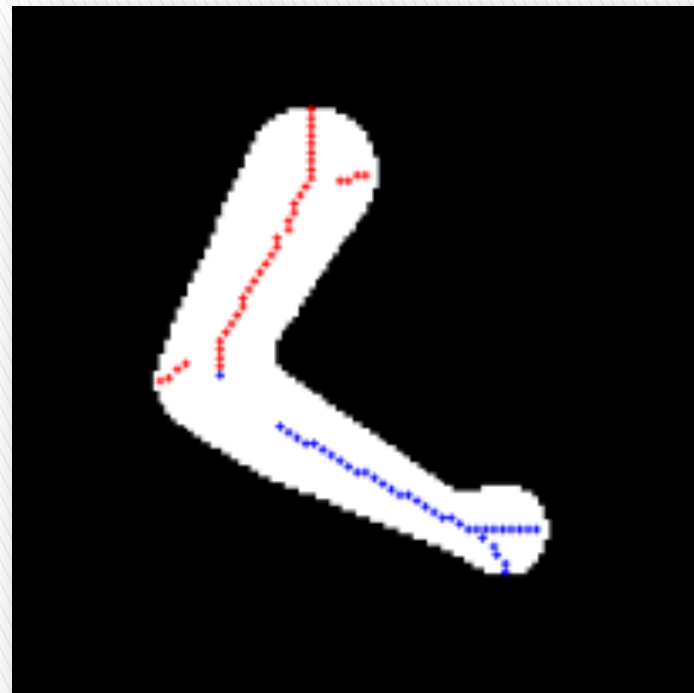


Algoritmo Heurístico

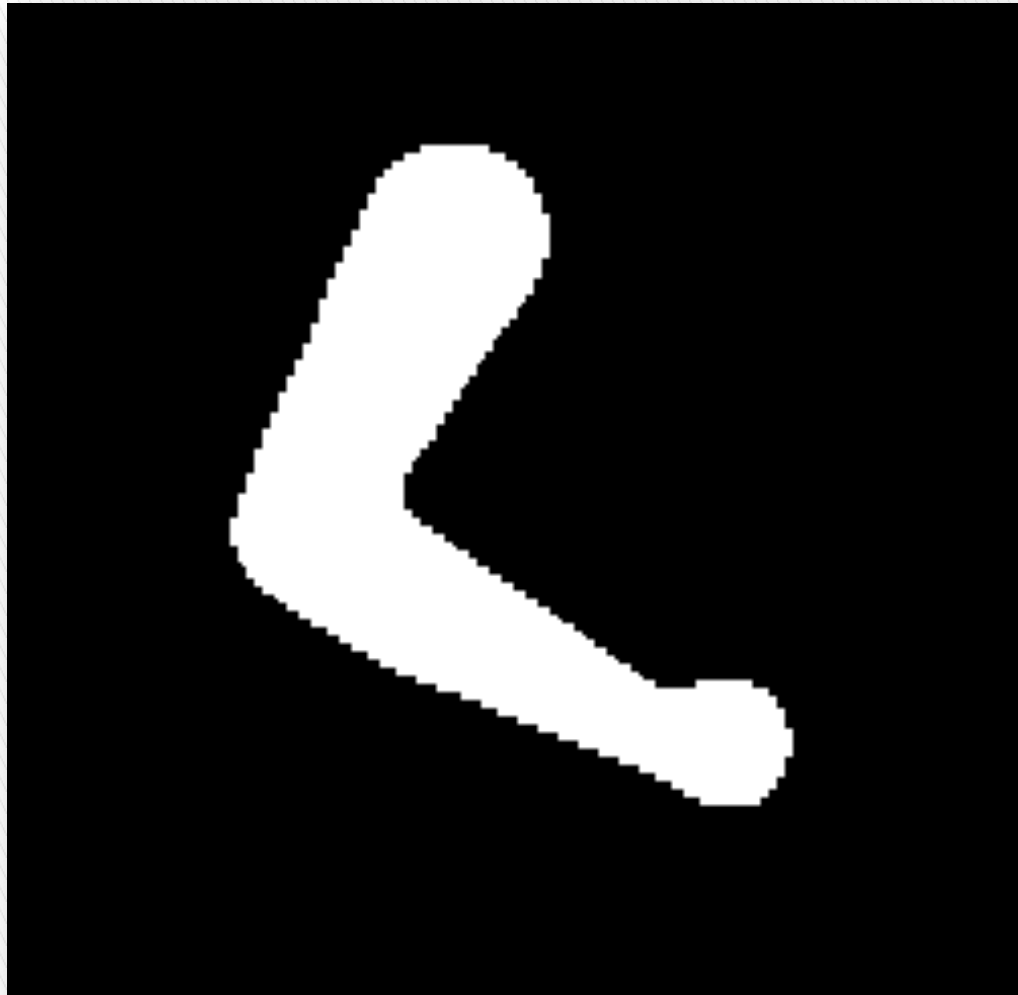
# Pre-procesamiento



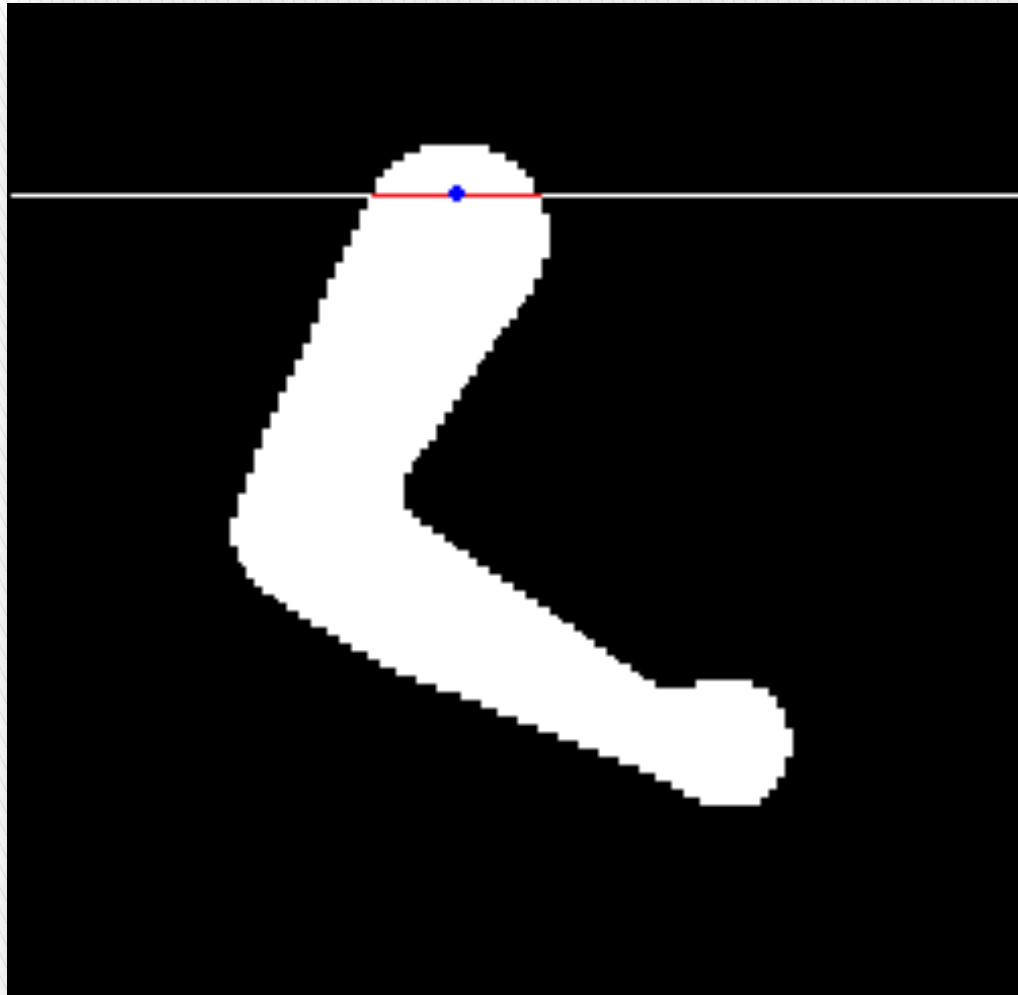
Entrada



Salida

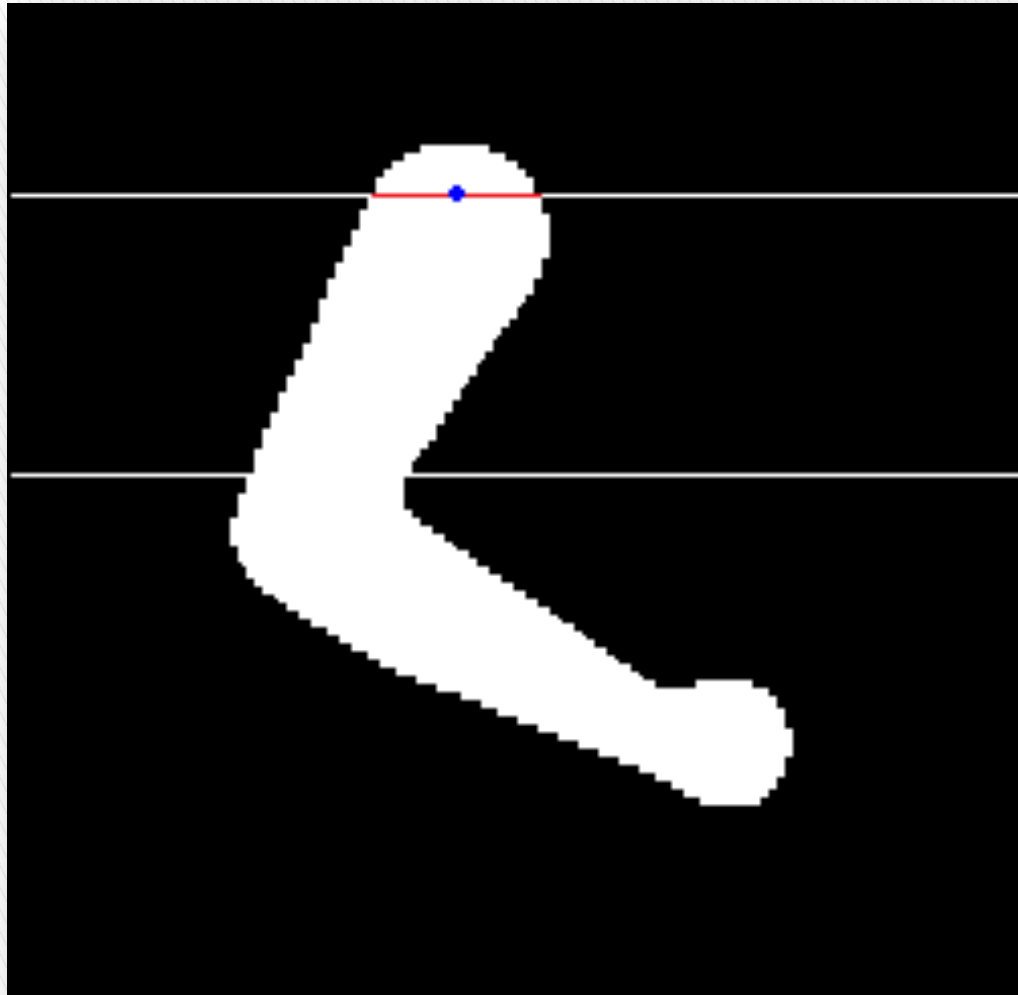


Pre-procesamiento

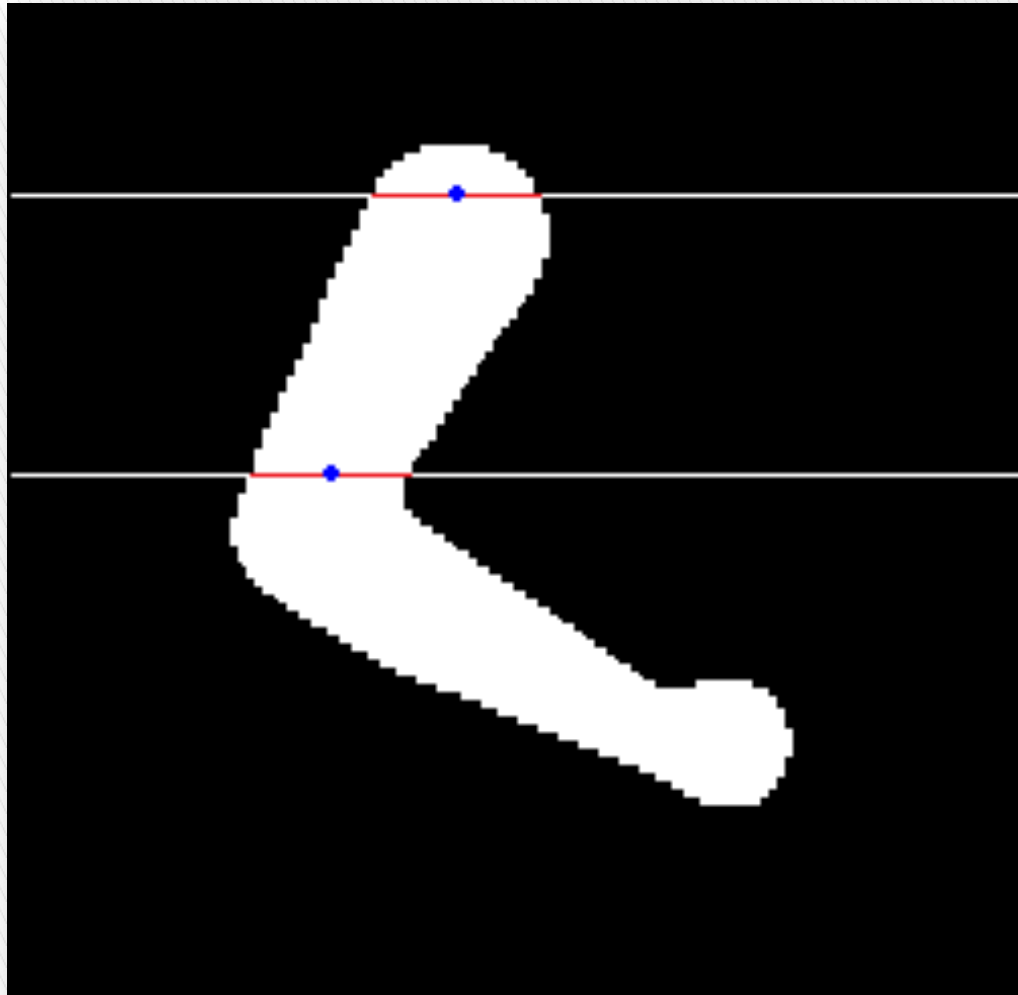


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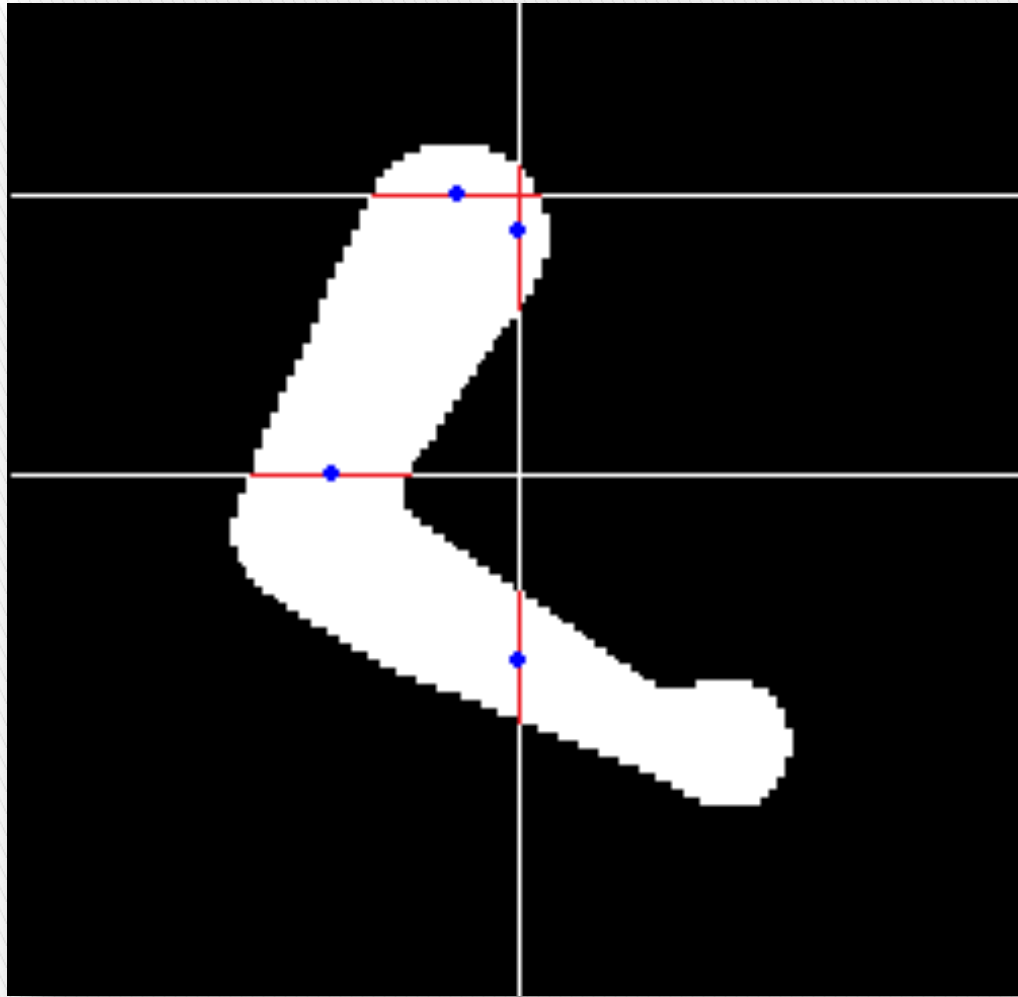




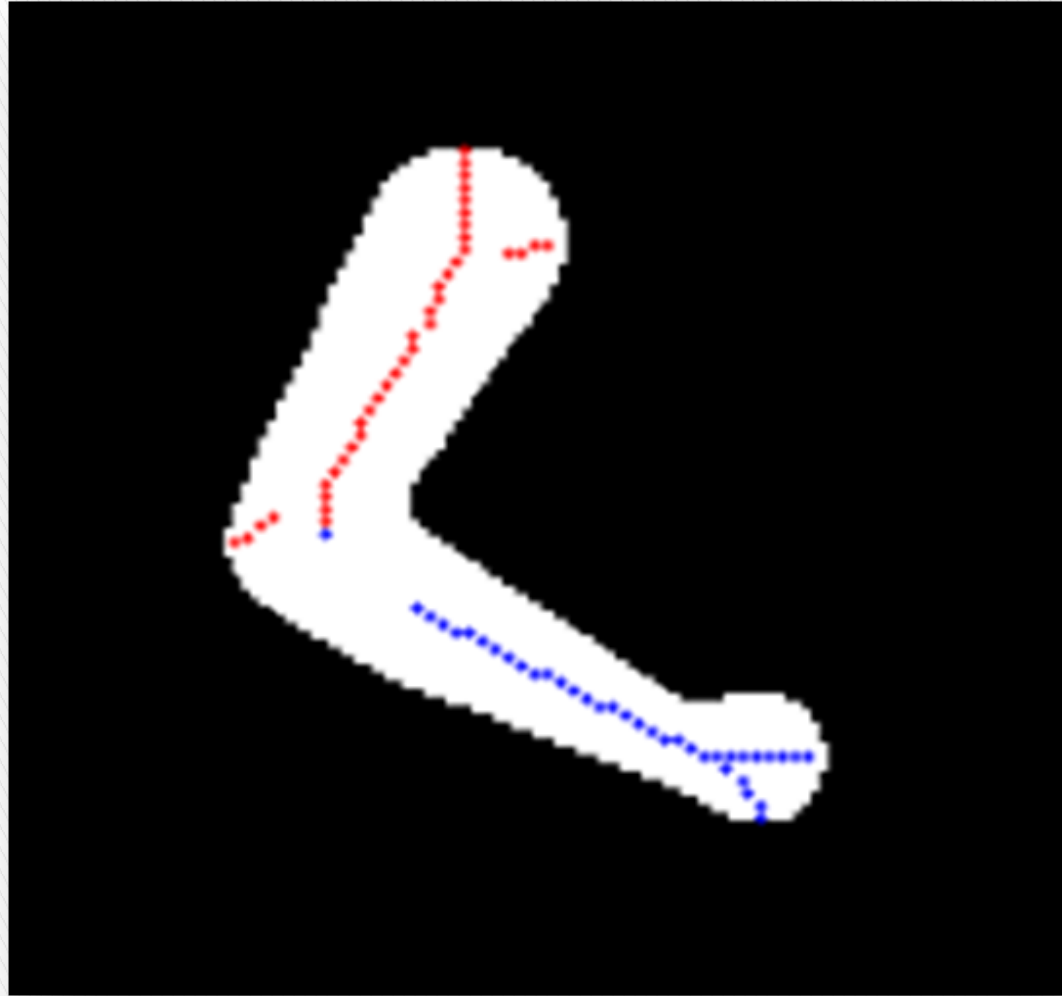
Pre-procesamiento



Pre-procesamiento



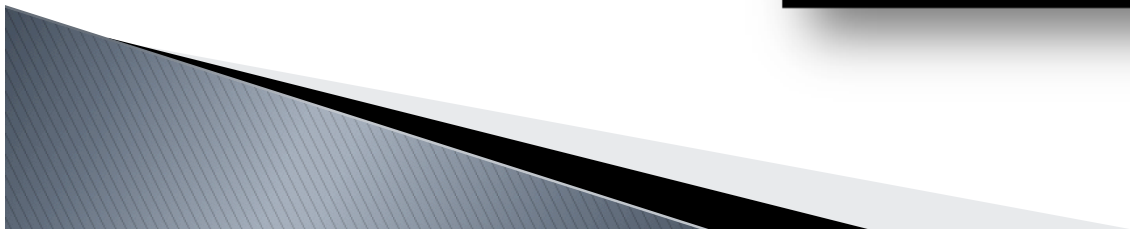
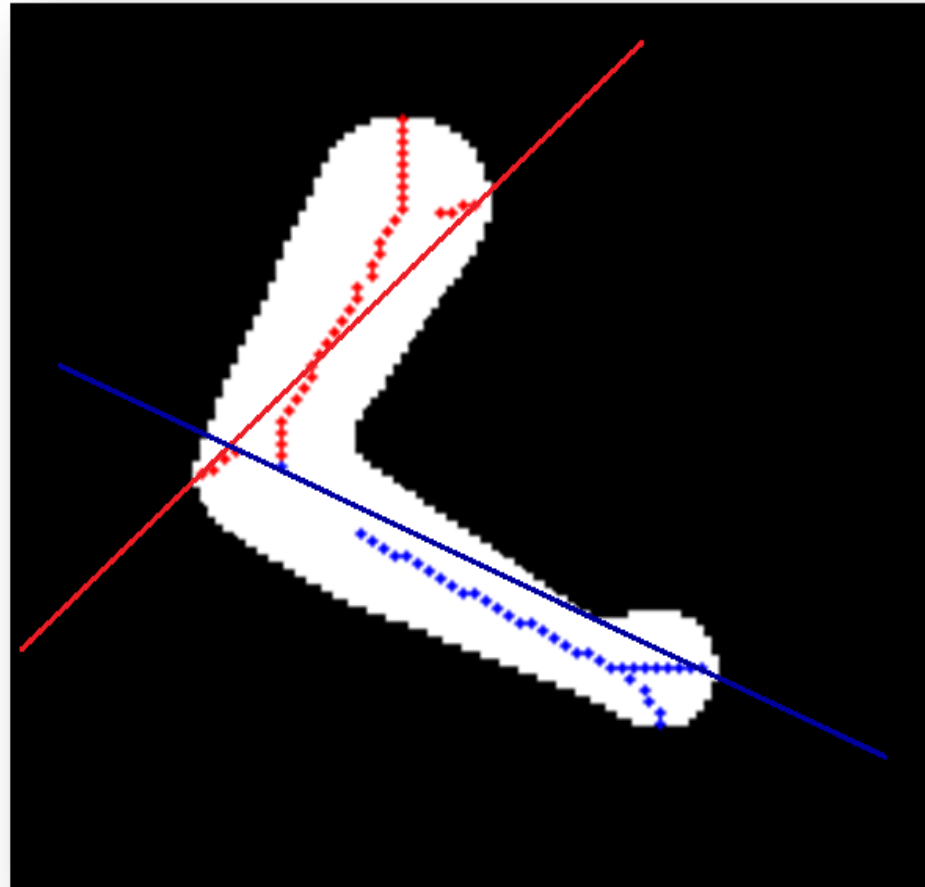
Pre-procesamiento



Pre-procesamiento

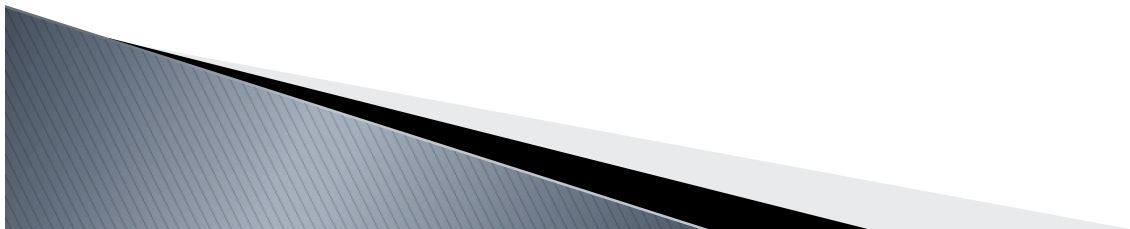
# Recocido Simulado

- ▶ Recta inicial.



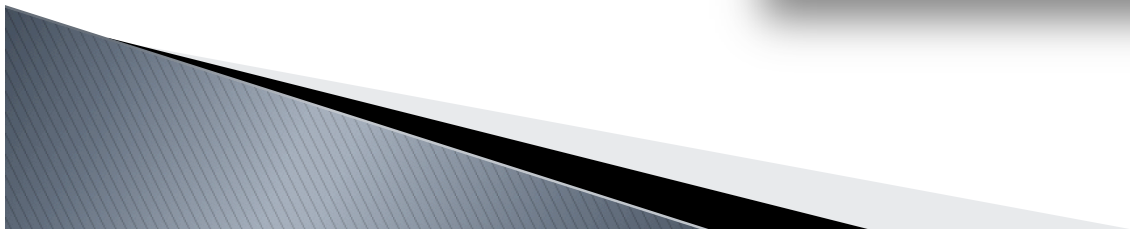
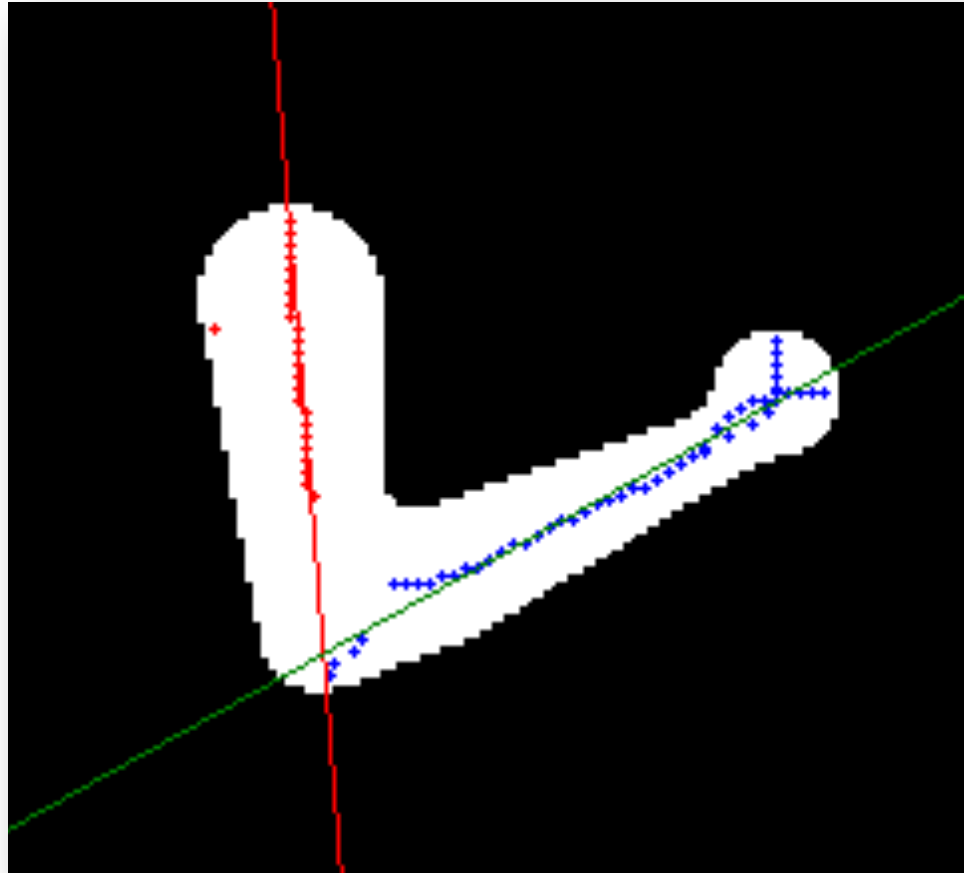
# Recocido Simulado

- ▶ Recta inicial
- ▶  $T \downarrow 0 = 30$
- ▶ Nuevas soluciones se generan a partir de una vecindad aleatoria de los puntos anteriores.



# Recocido Simulado

- ▶ Resultado:



# Simplex

▶ Función objetivo:  $\min z = \sum_{i=1}^n |Ax_i + By_i + C| / \sqrt{A^2 + B^2}$

▶ Propuesta lineal:  $\min z = \sum_{i=1}^n |Ax_i + By_i + C|$

$$s.a.: A + |B| \geq \varepsilon$$

▶ Modelo final:  $\min z = \sum_{i=1}^n P_i$

$$s.a.: Ax_i + By_i + C \leq P_i$$

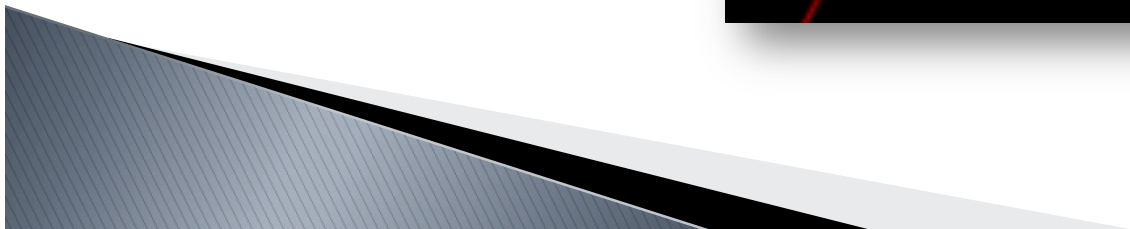
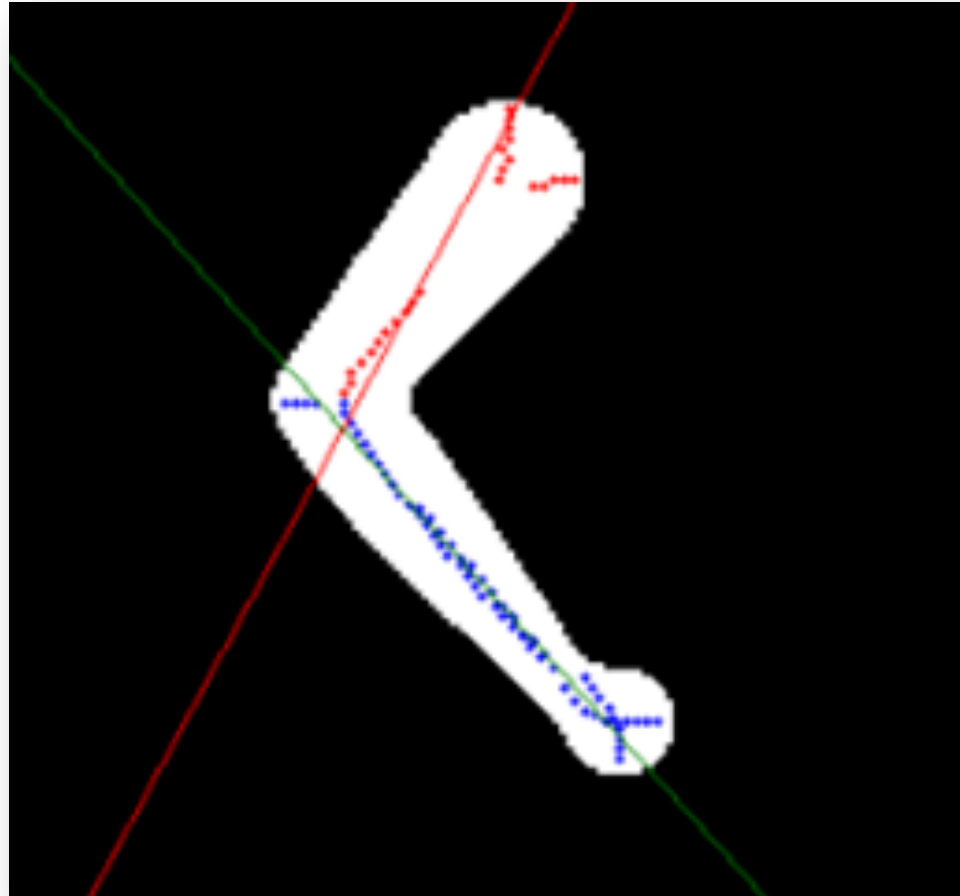
$$-Ax_i - By_i - C \leq P_i \quad A + B \geq \varepsilon \quad A - B \geq \varepsilon \quad P_i \geq 0$$





# Simplex

- ▶ Resultado:

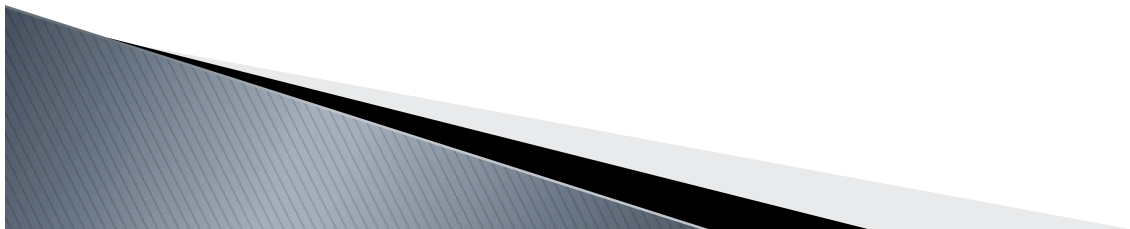


# Gauss–Newton y Levenberg–Marquardt

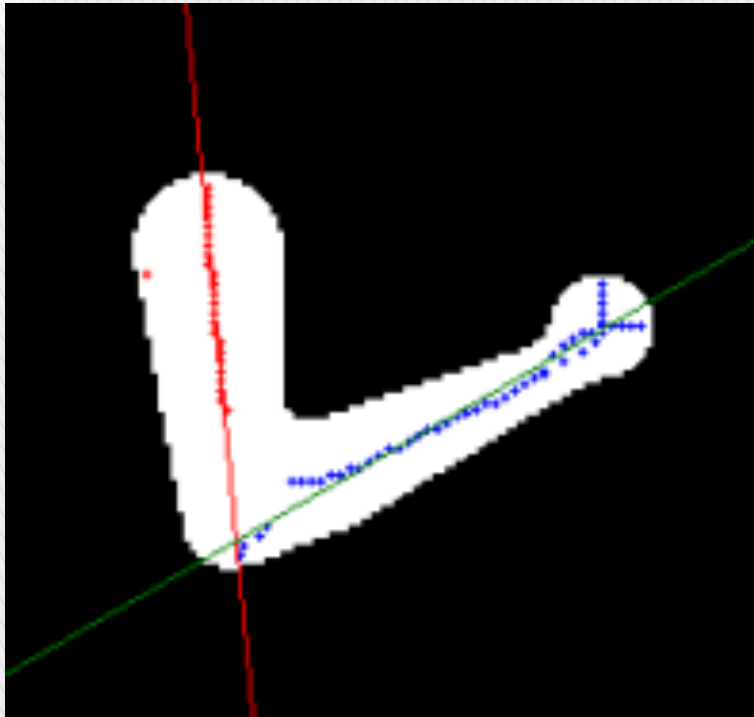
- ▶ Encontrar  $A$ ,  $B$  y  $C$  en la función:

$$f(x,y) = |Ax + By + C| / \sqrt{A^2 + B^2}$$

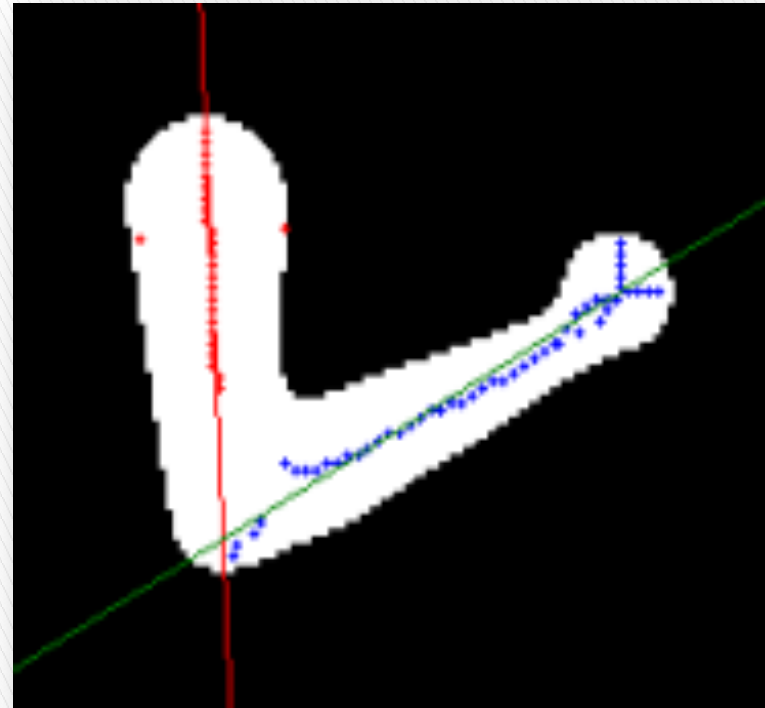
- ▶  $x^{\wedge} = x + \alpha d$ , donde  $\alpha$  se calcula utilizando la regla de Armijo.



# Resultados



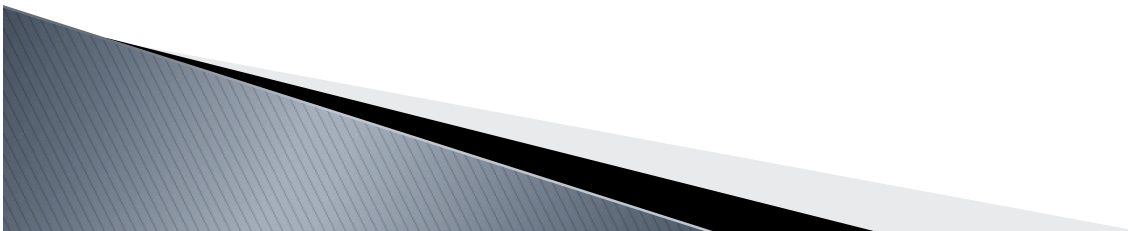
Gauss-Newton



Levenberg-Marquardt:

# Resultados Generales

- ▶ Generador de imágenes.



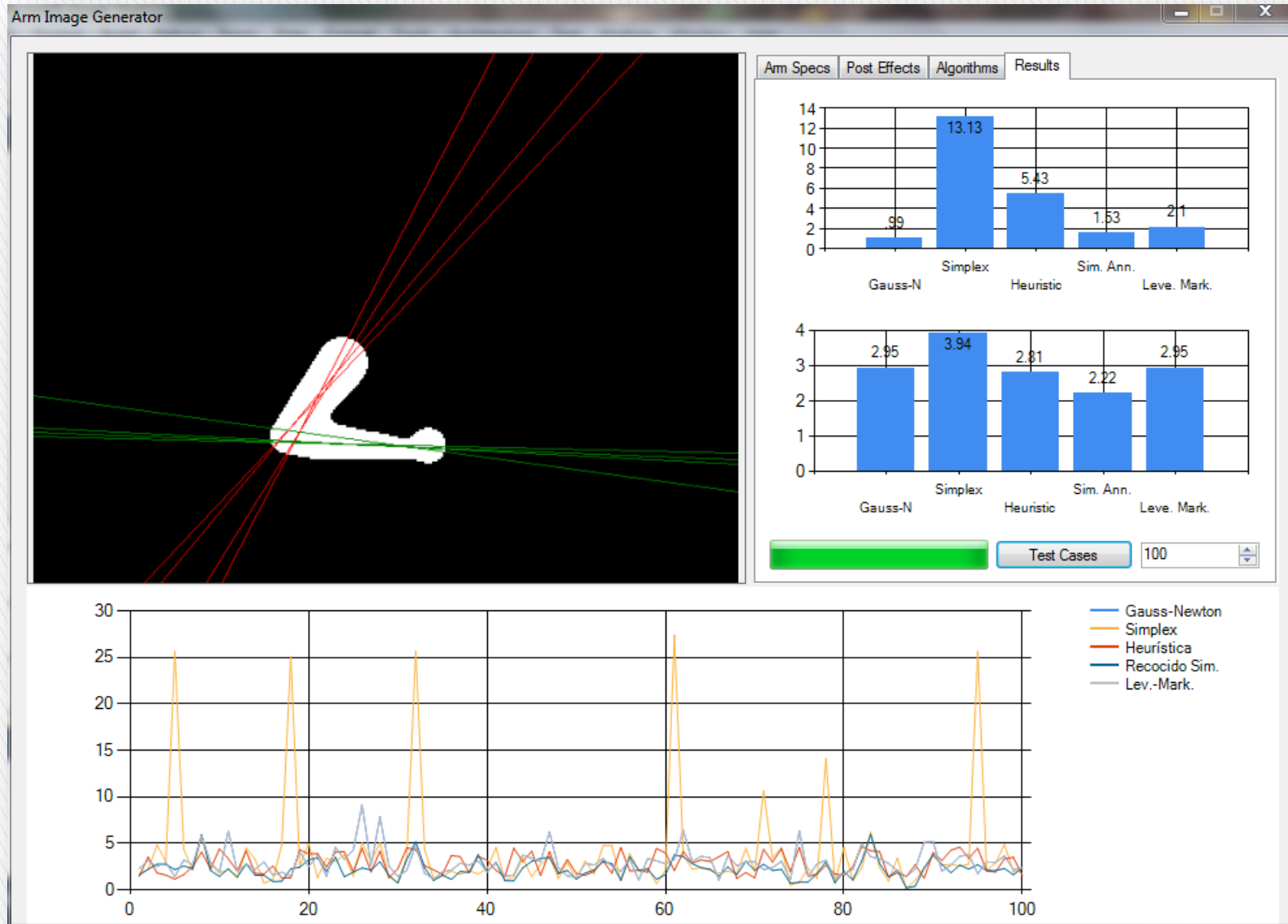
# Imágenes Generadas



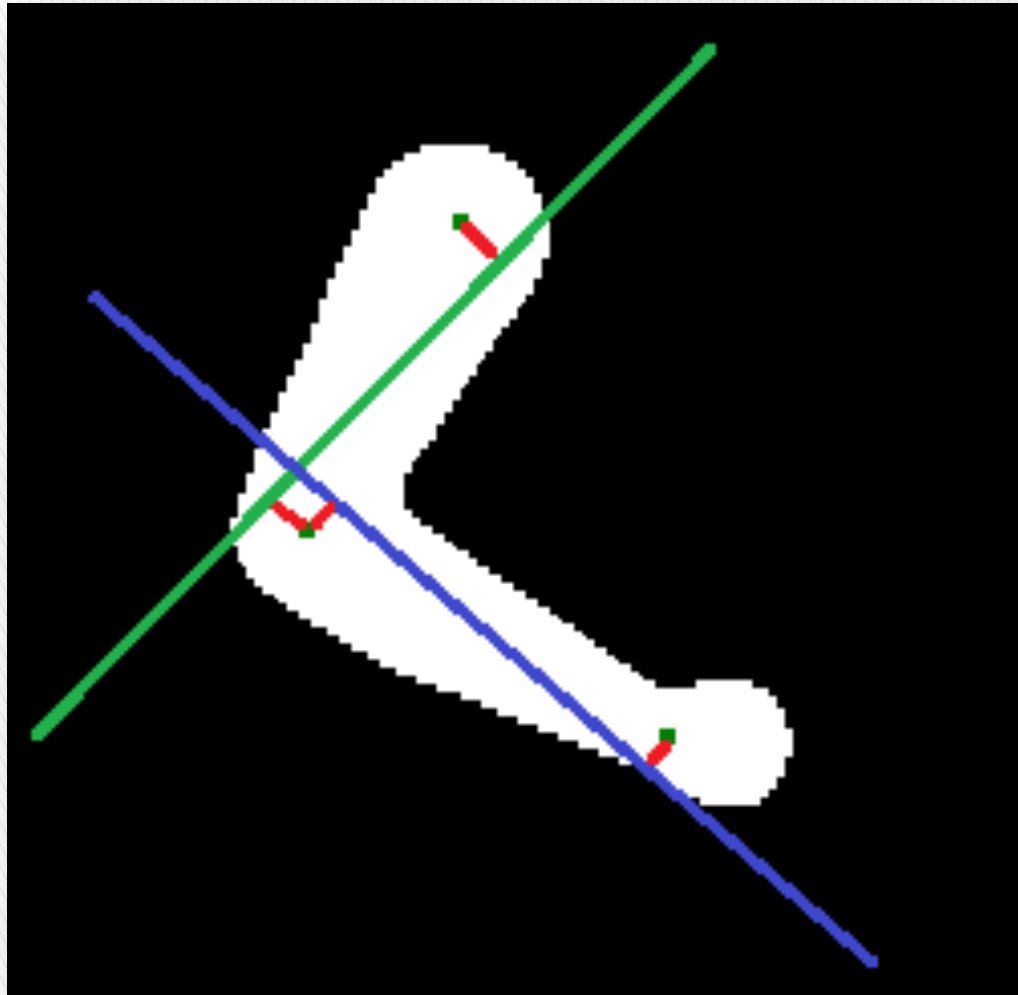
Real



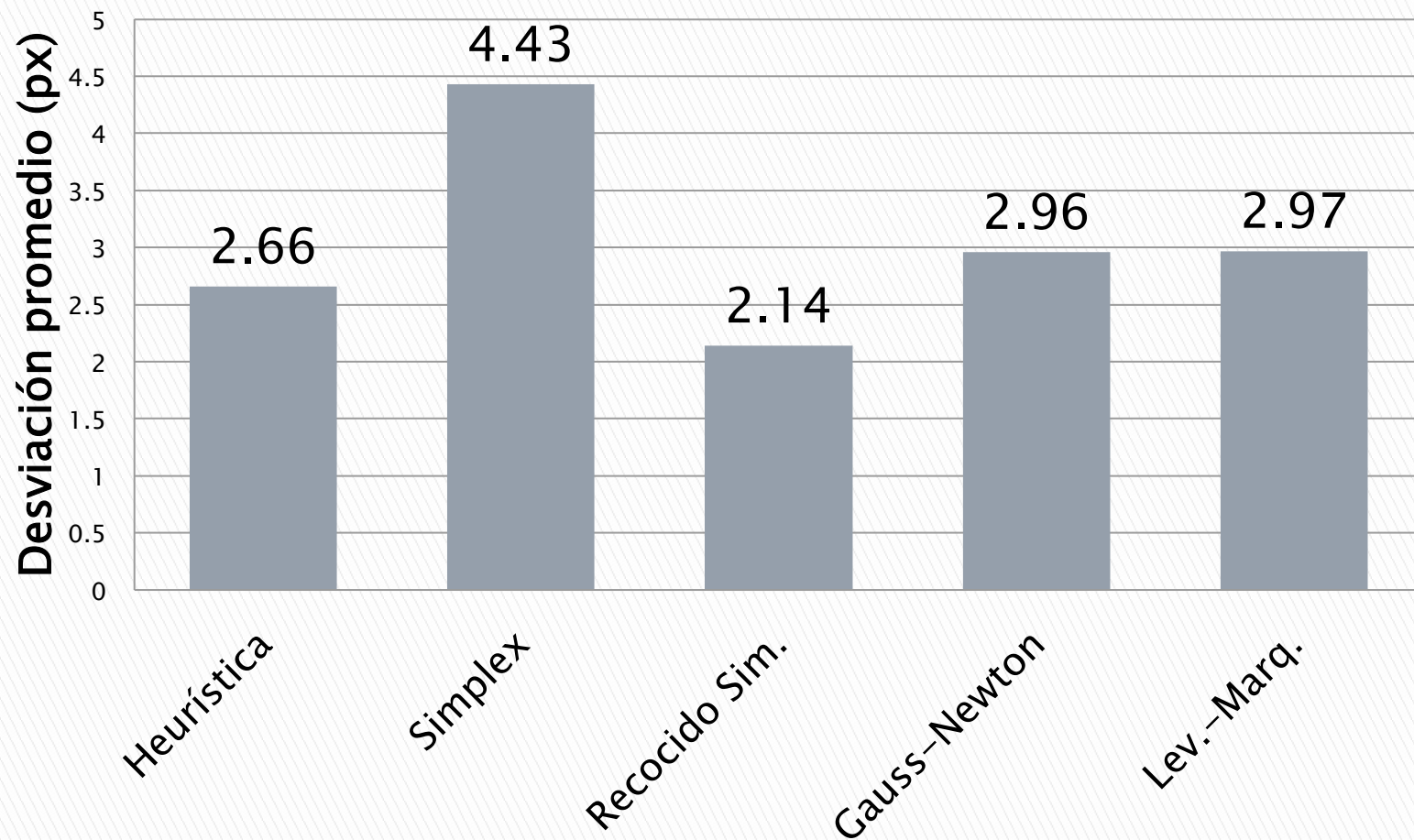
Artificial



Generador de imagenes



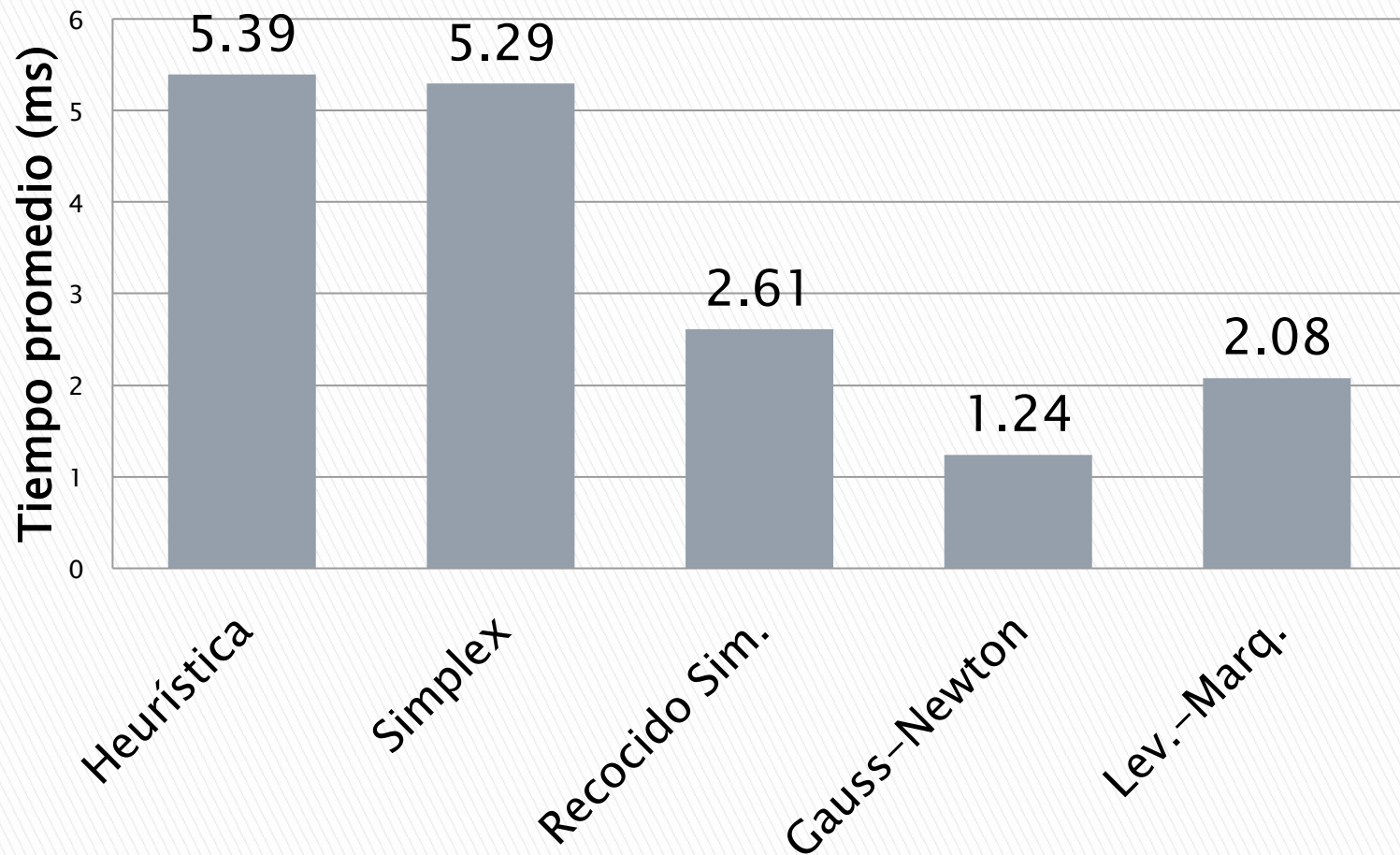
Desviación Promedio



## Precisión

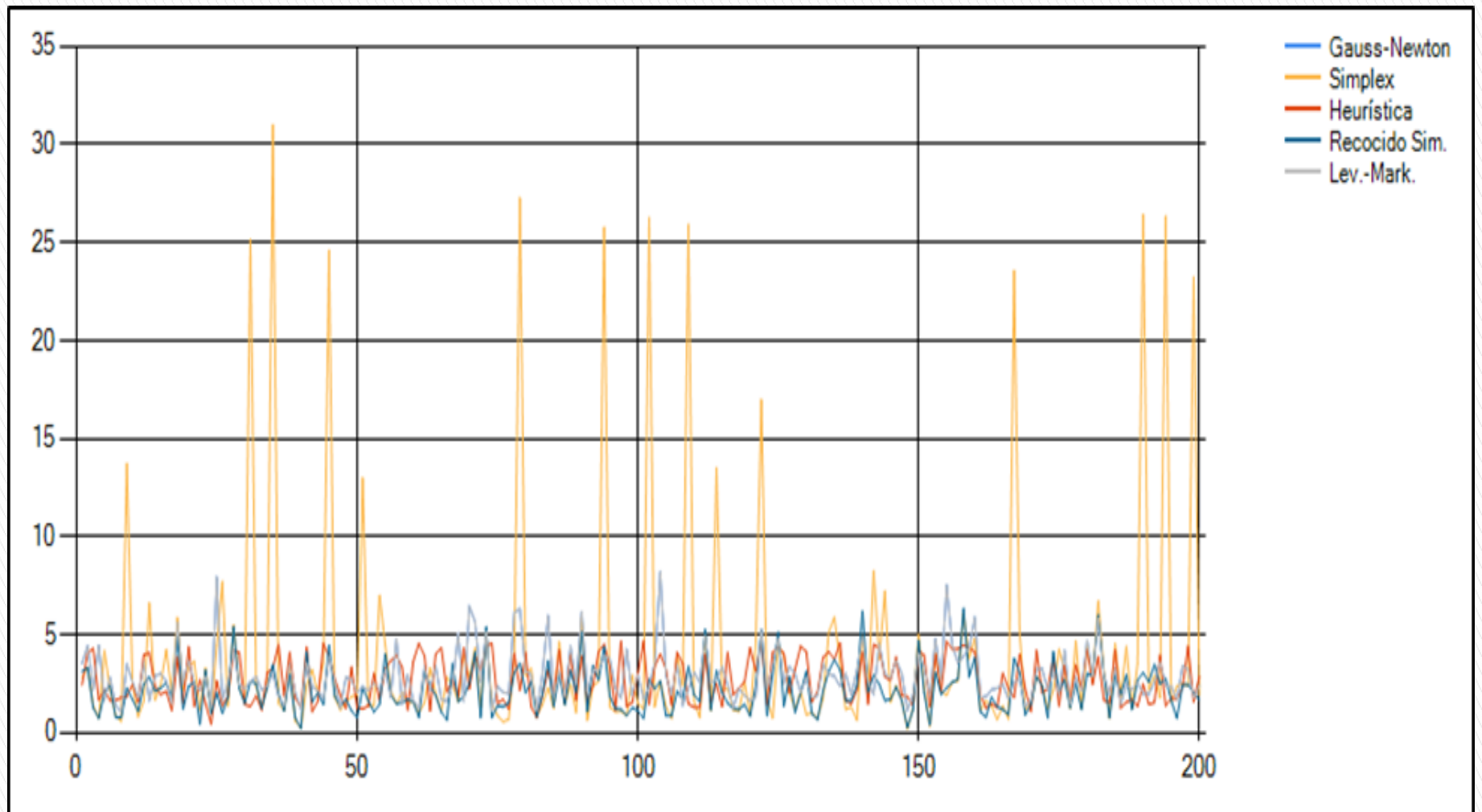
Precisión de los algoritmos  
atendiendo a su desviación promedio  
en 10000 imágenes aleatorias





## Tiempo

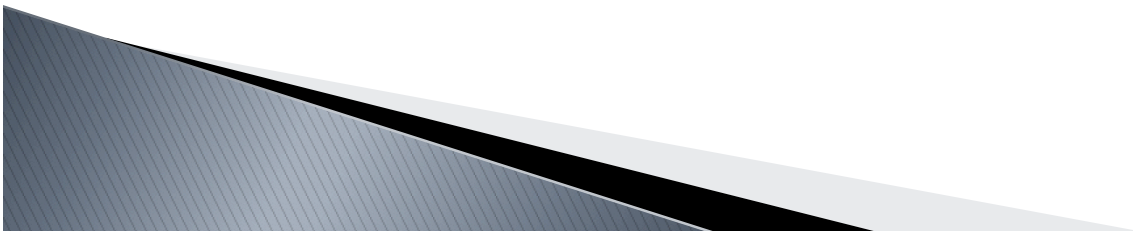
Tiempo promedio de los algoritmos para analizar una imagen



## Calidad

Calidad de los algoritmos en 200 imágenes aleatorias.

# Conclusiones



# Estudio de algoritmos para la estimación de la posición de un brazo a partir de su imagen.

EMNO 2015

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Tutor: M.Sc. Oscar Luis Vera.