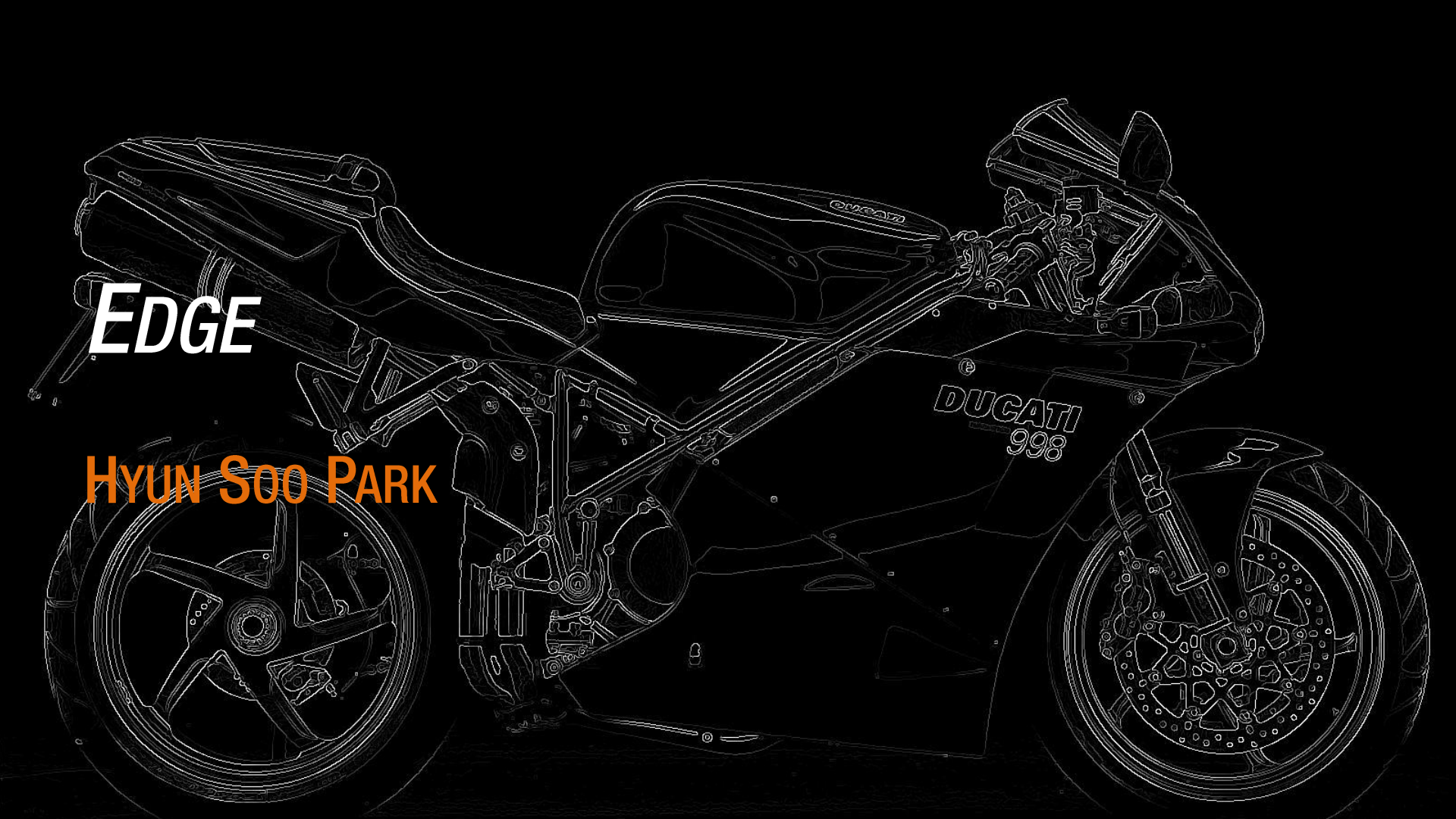
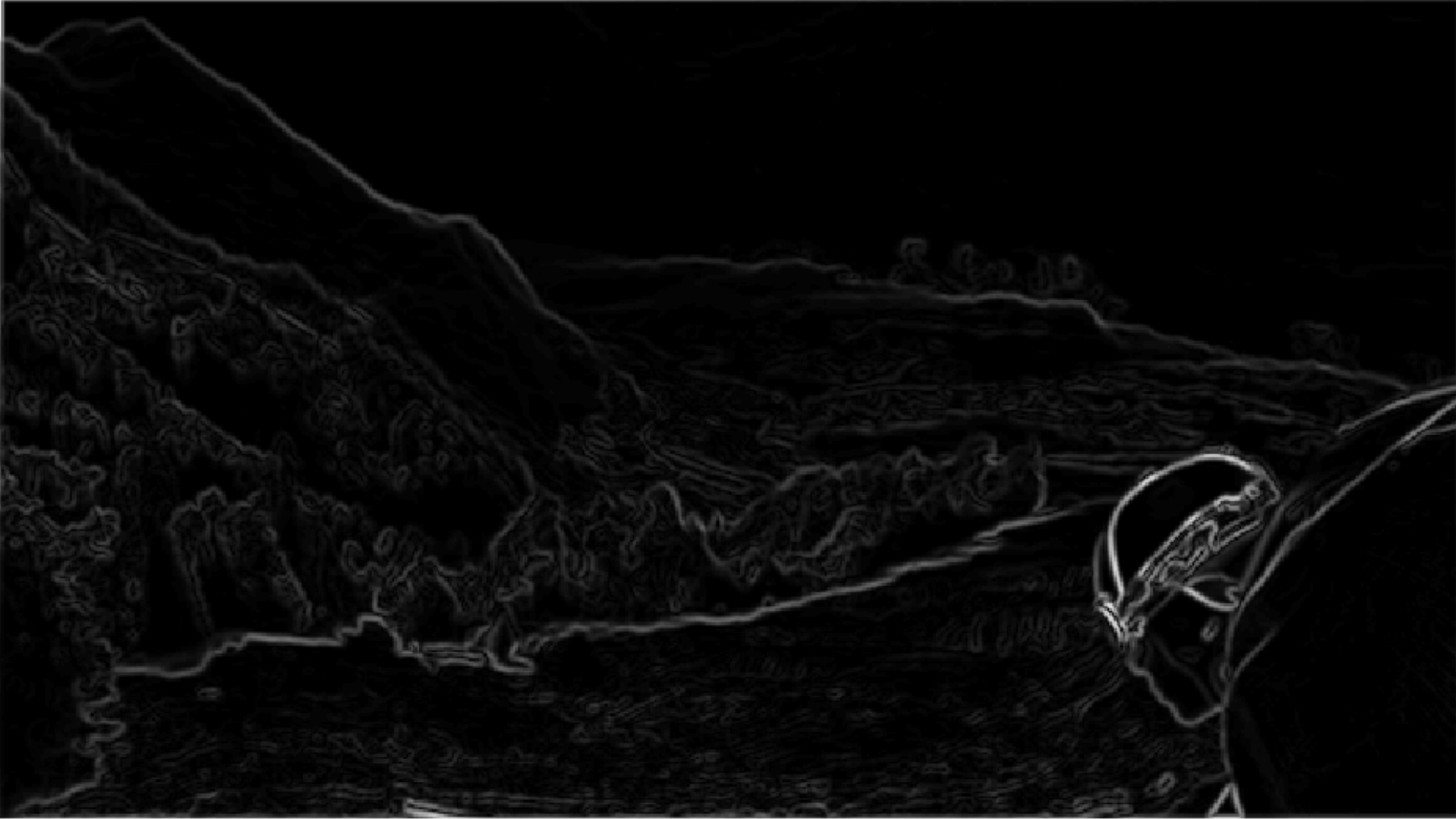
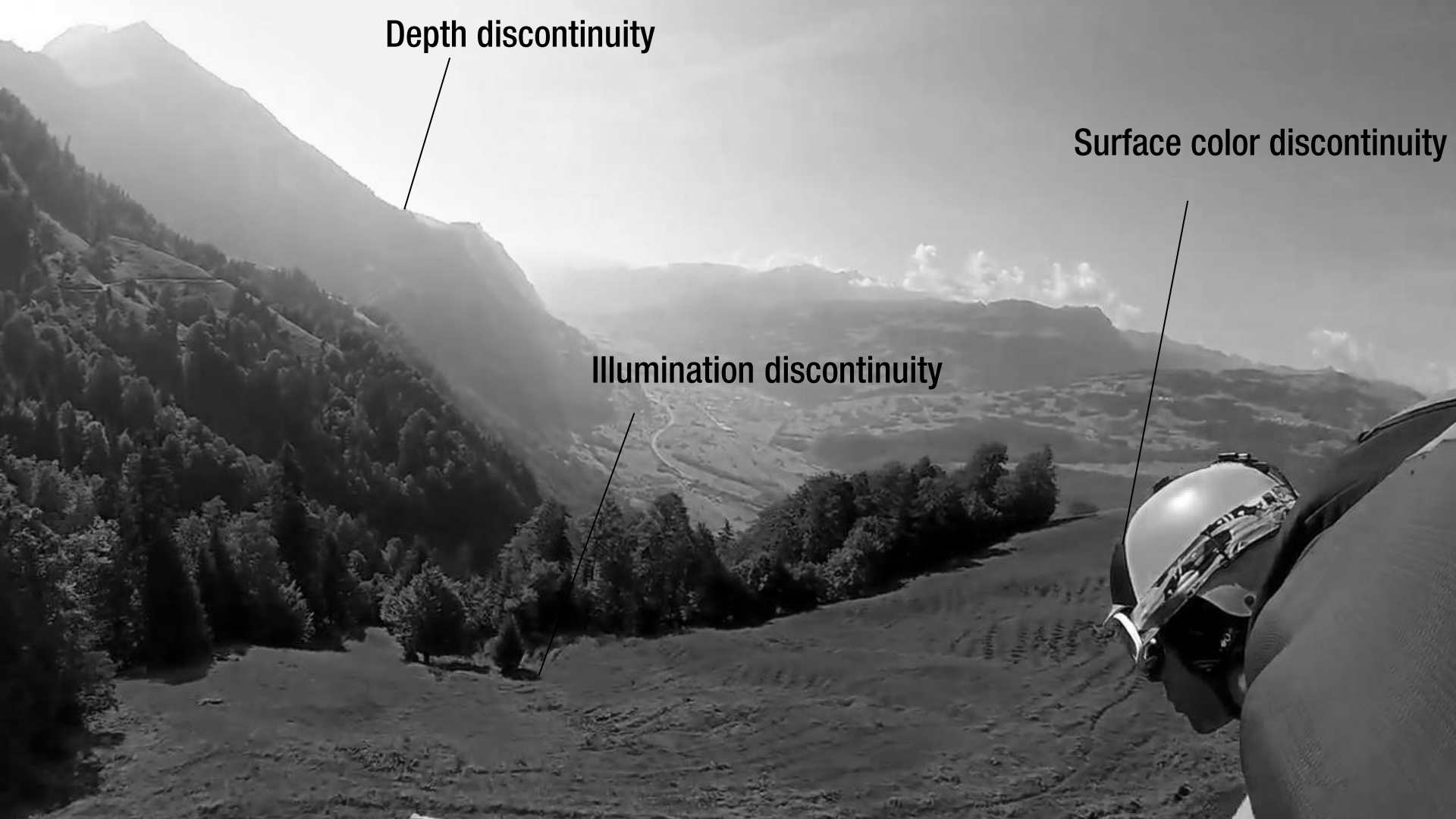
EDGE

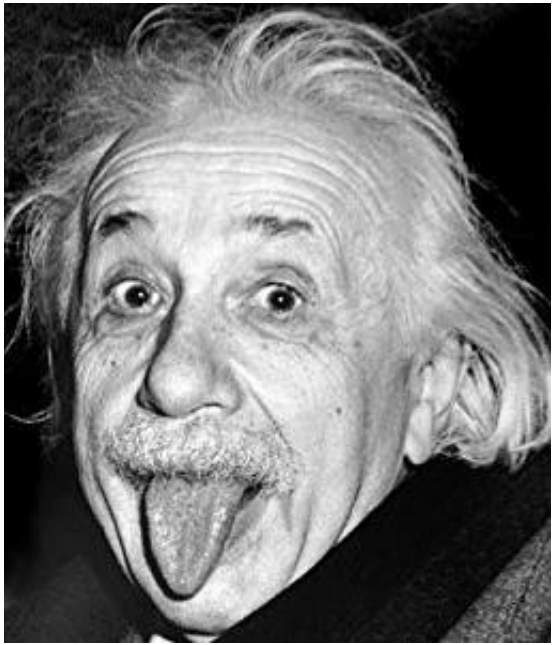
HYUN SOO PARK






Depth discontinuity
Surface color discontinuity
Illumination discontinuity

Edge Detection: Would Magnitude Thresholding Work?



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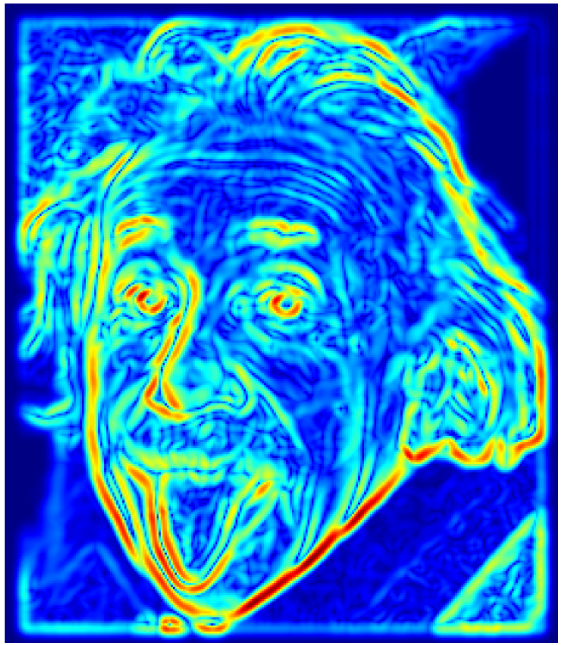
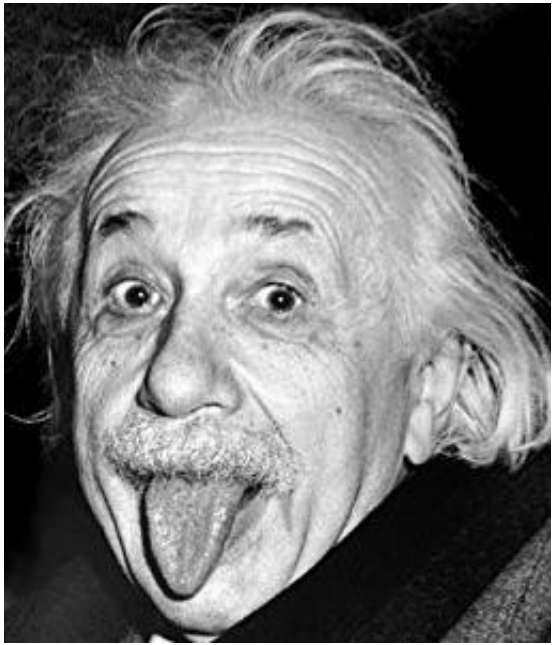


$\|\nabla I\| > \varepsilon$

EDGE DETECTION: WOULD MAGNITUDE THRESHOLDING WORK?



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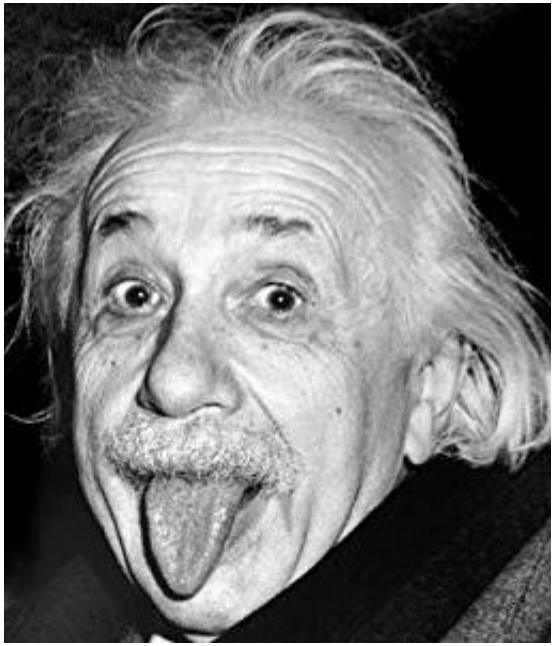
$\|\nabla I\| > \varepsilon$

Edge Detection: Would Magnitude Thresholding Work?



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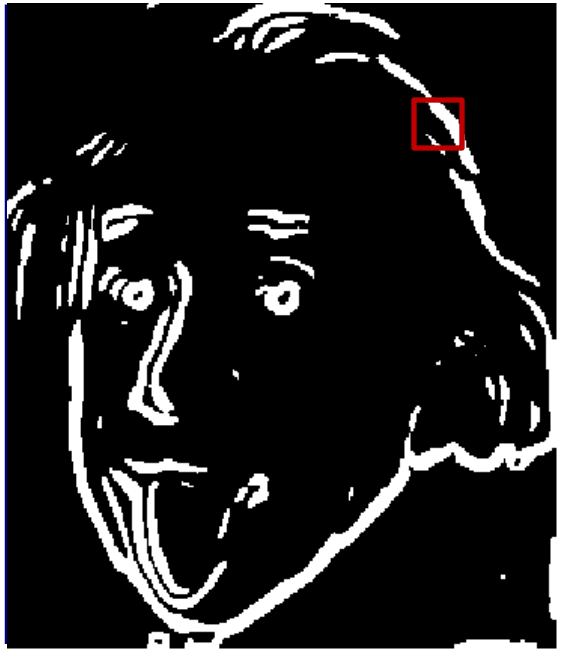
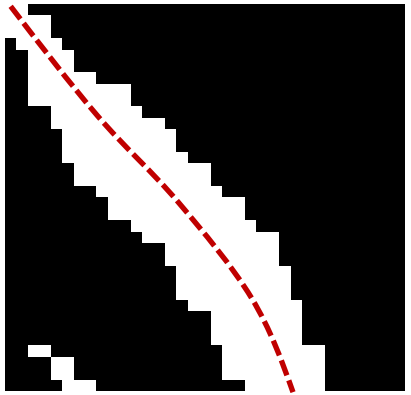
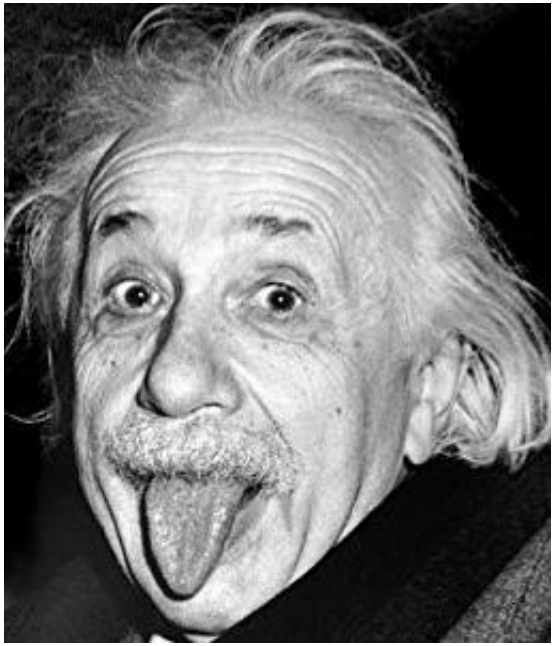


$\|\nabla I\| > \varepsilon$

Non-locality



Edge Detection: Would Magnitude Thresholding Work?



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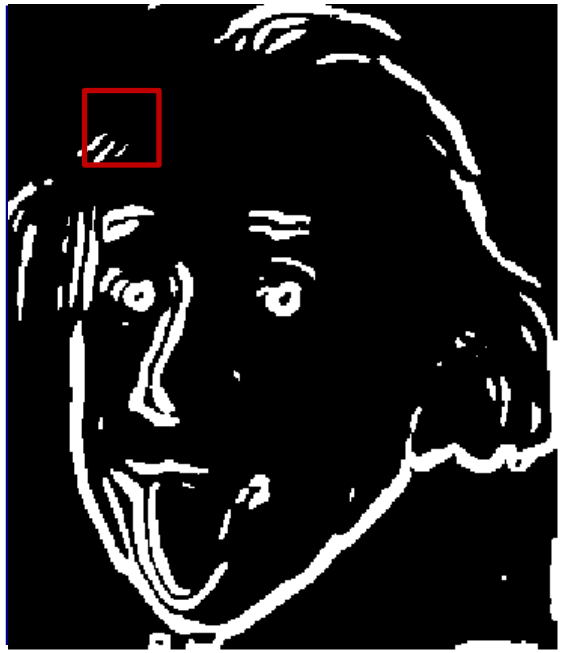
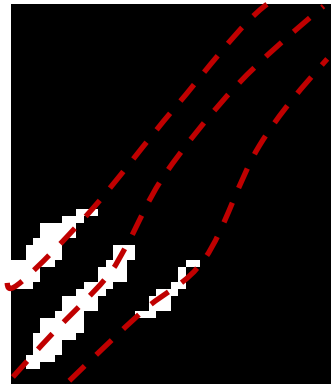


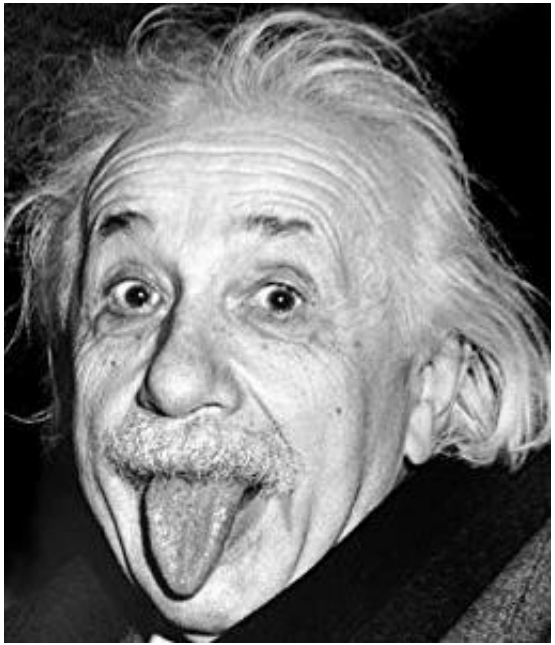
$\|\nabla I\| > \varepsilon$

Non-locality

Discontinuity



CANNY EDGE DETECTOR



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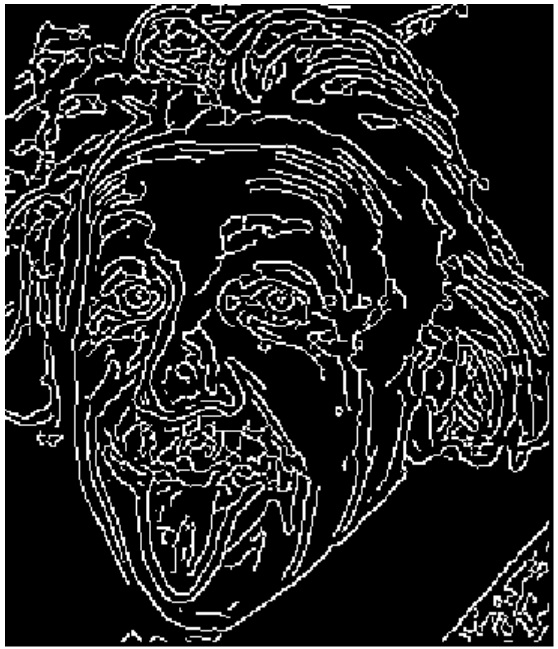
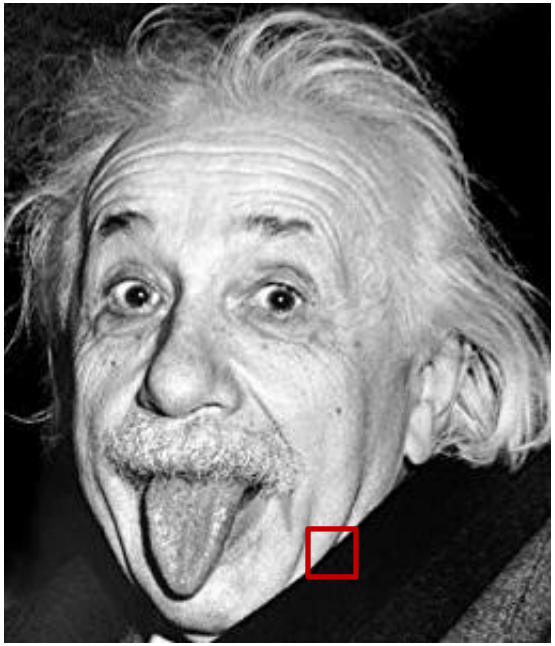


John F. Canny, UC Berkely

Canny, *A Computational Approach to Edge Detection*, TPAMI (1986)

Edge Localization: Non-maximum Supression



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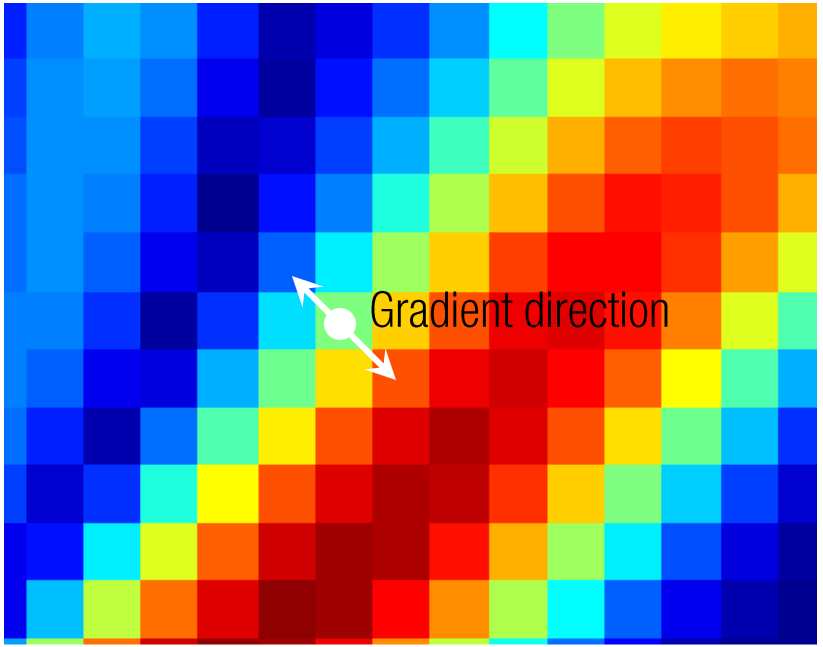
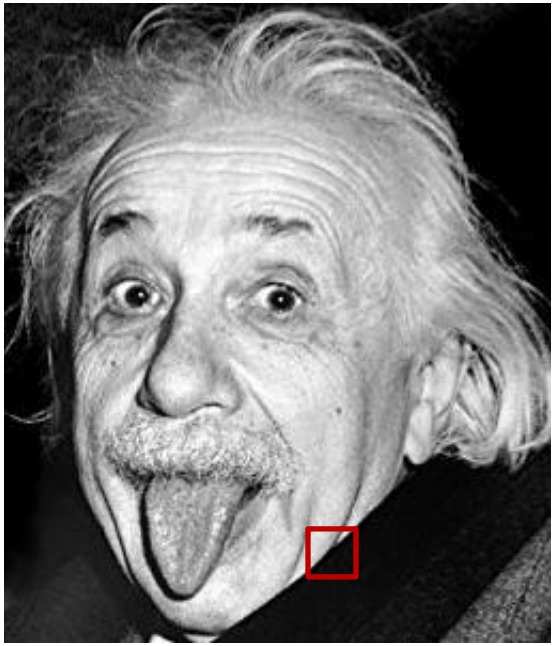


Edge response

Check if the pixel is local maximum along the gradient direction

EDGE LOCALIZATION: NON-MAXIMUM SUPRESSION



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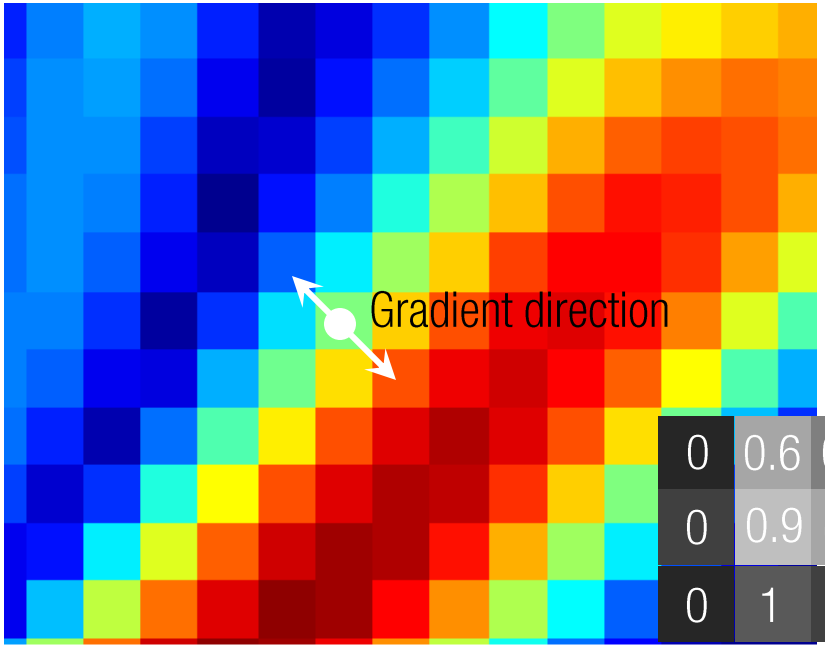


Edge response

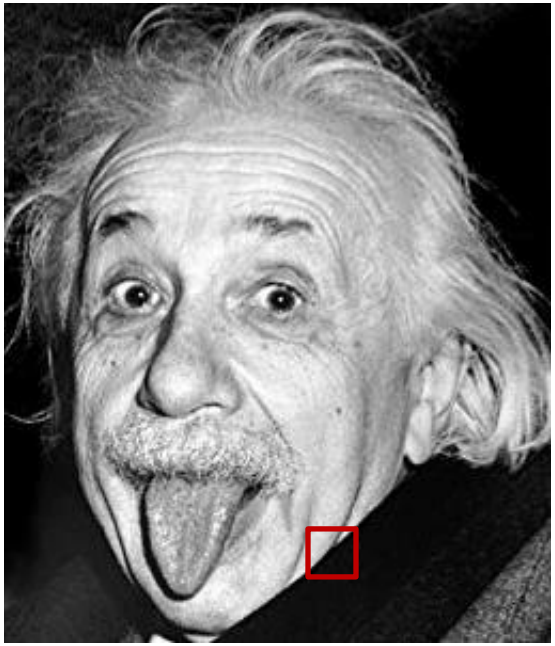
Check if the pixel is local maximum along the gradient direction

0	0.6	0.8
0	0.9	0.7
0	1	0

NMS

0	0	0.8
0	0.9	0
0	1	0

Edge Localization: Non-maximum Supression



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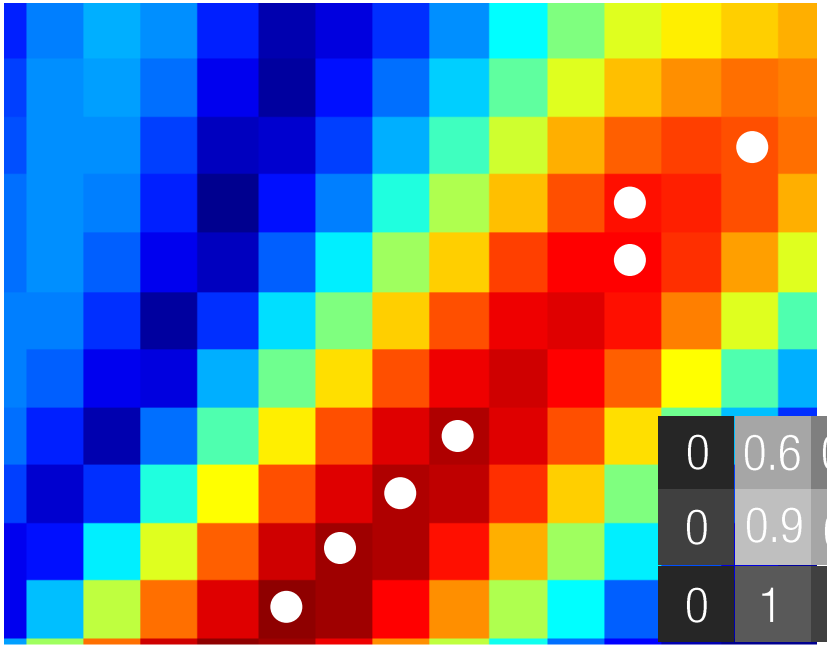


Edge response

Check if the pixel is local maximum along the gradient direction

0	0.6	0.8
0	0.9	0.7
0	1	0

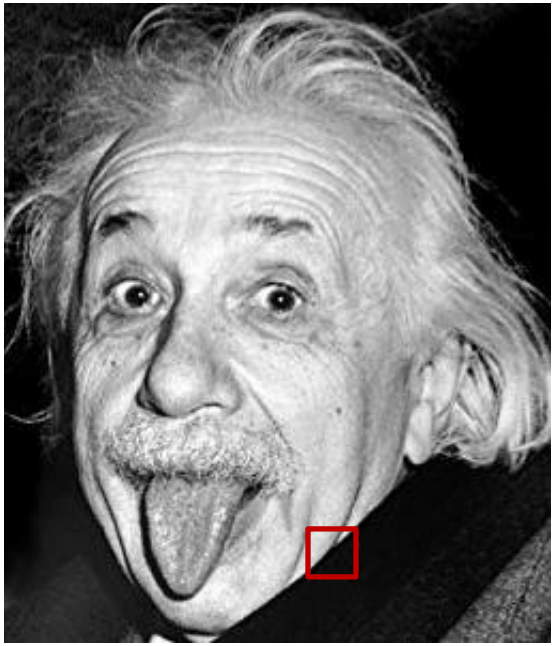
NMS

0	0	0.8
0	0.9	0
0	1	0

Thresholding

Localized edge

EDGE LINKING



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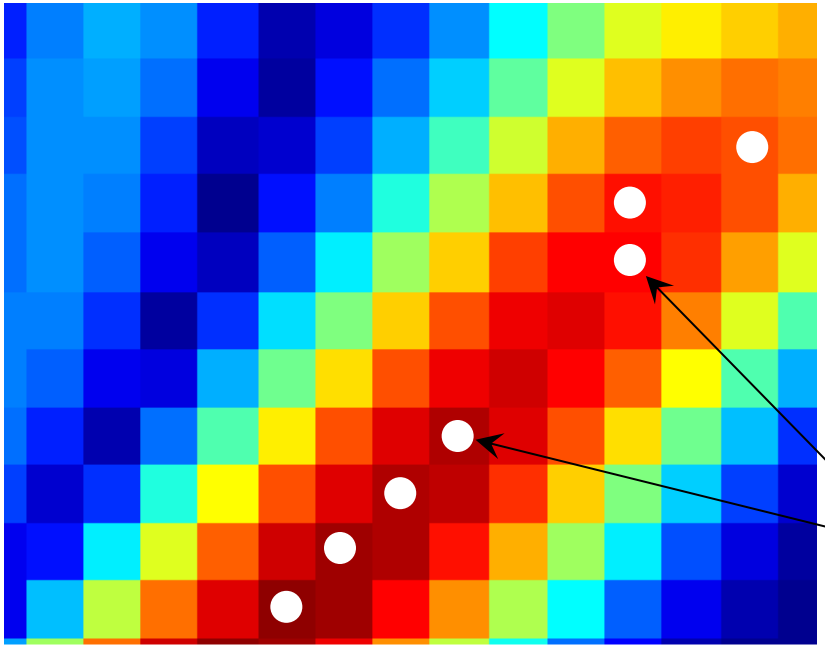
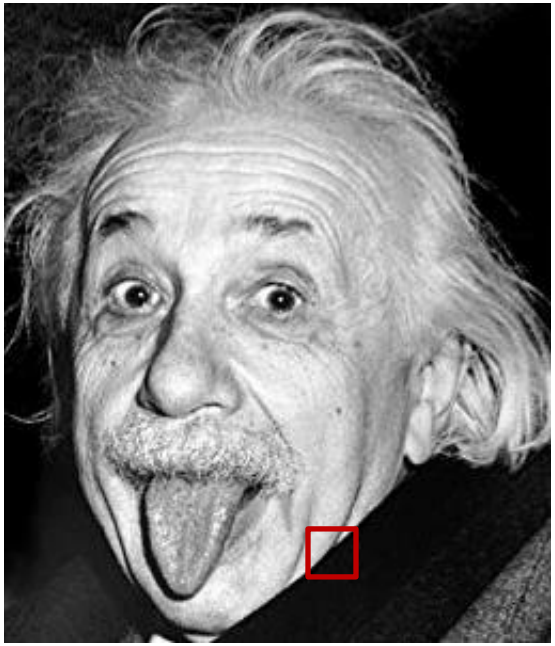


Edge response

EDGE LINKING



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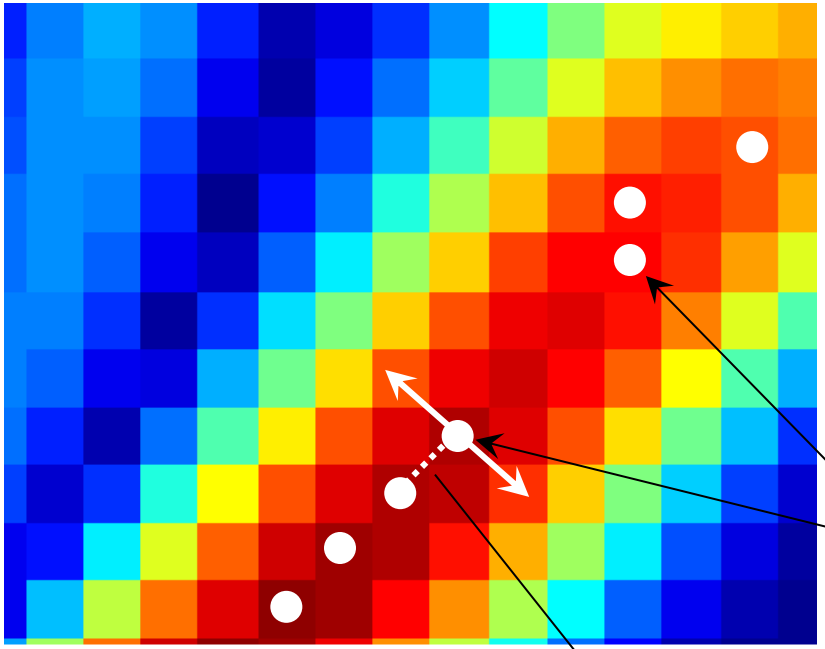
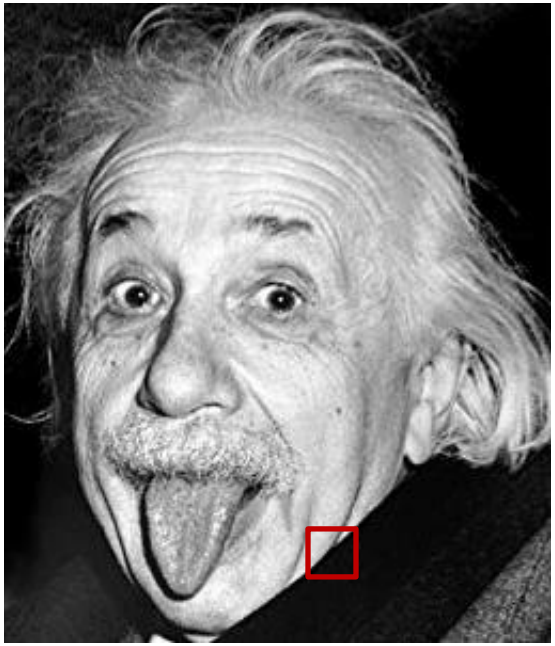


EDGE PREDICTION



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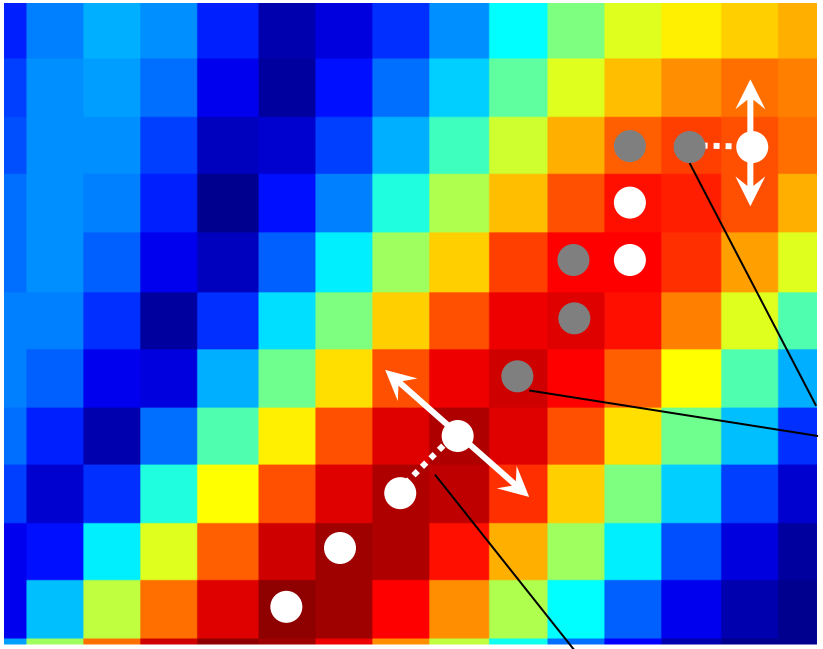
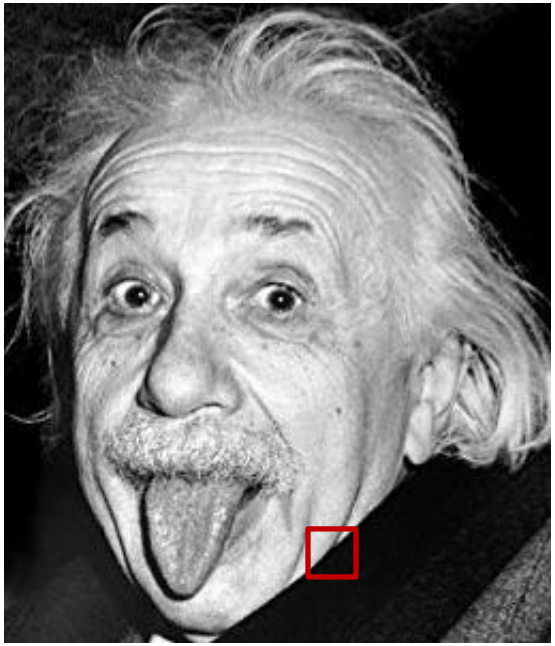


Next edge pixel prediction
➔ Tangent to the edge

Edge response

Edge linking

Edge Prediction: Hysteresis



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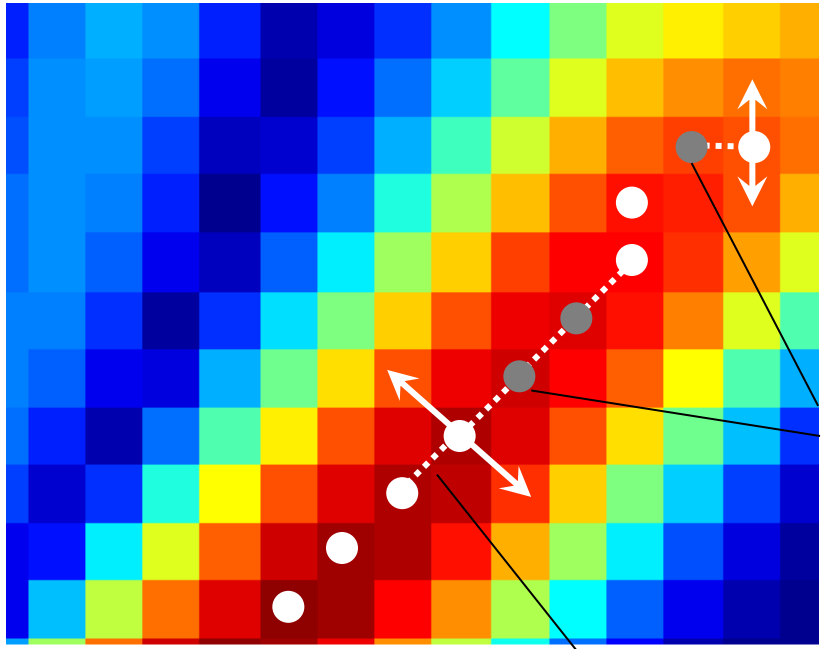
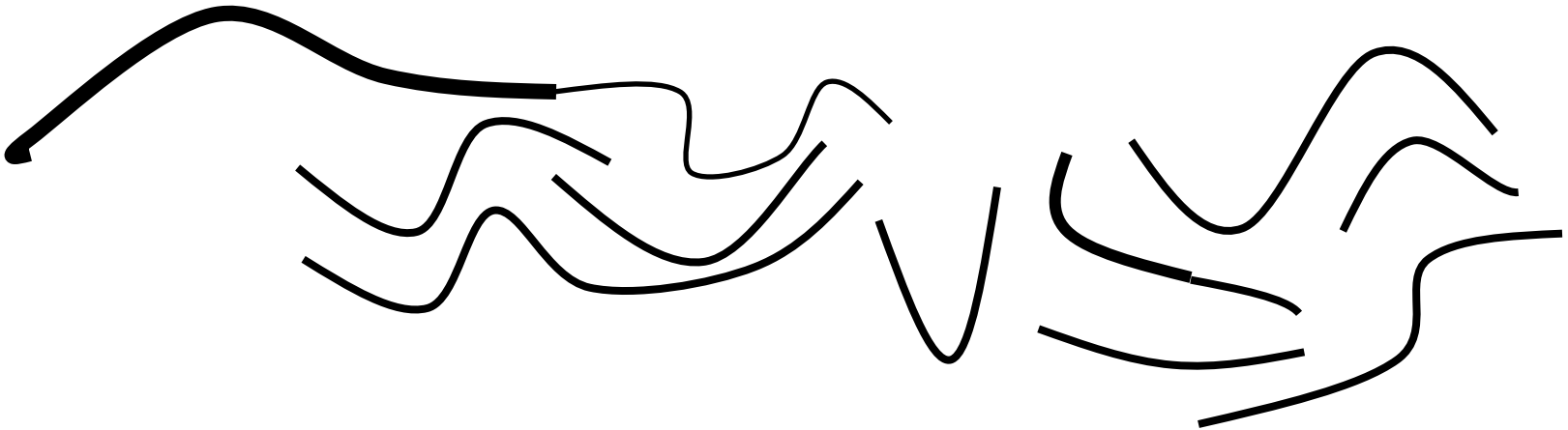


Next edge pixel prediction
➔ Tangent to the edge
Check if edge response is sufficiently large

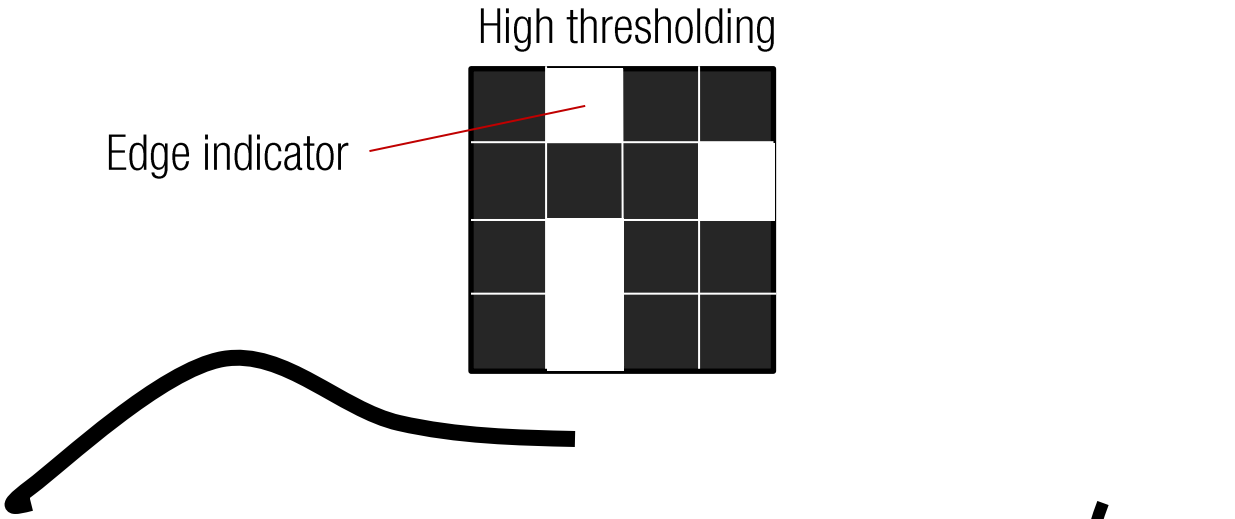
Edge response

Edge linking

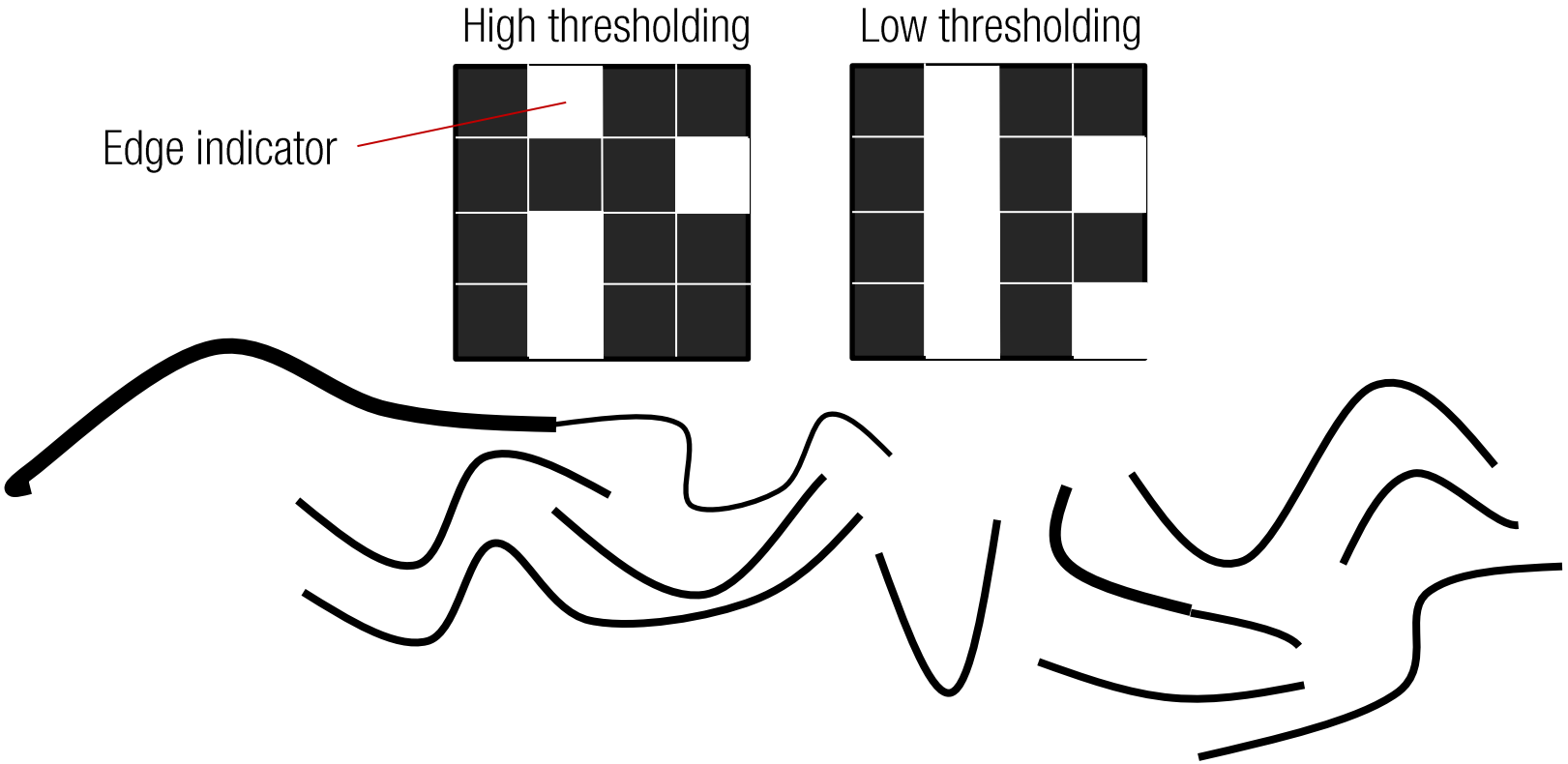
Edge Linking: Hysteresis



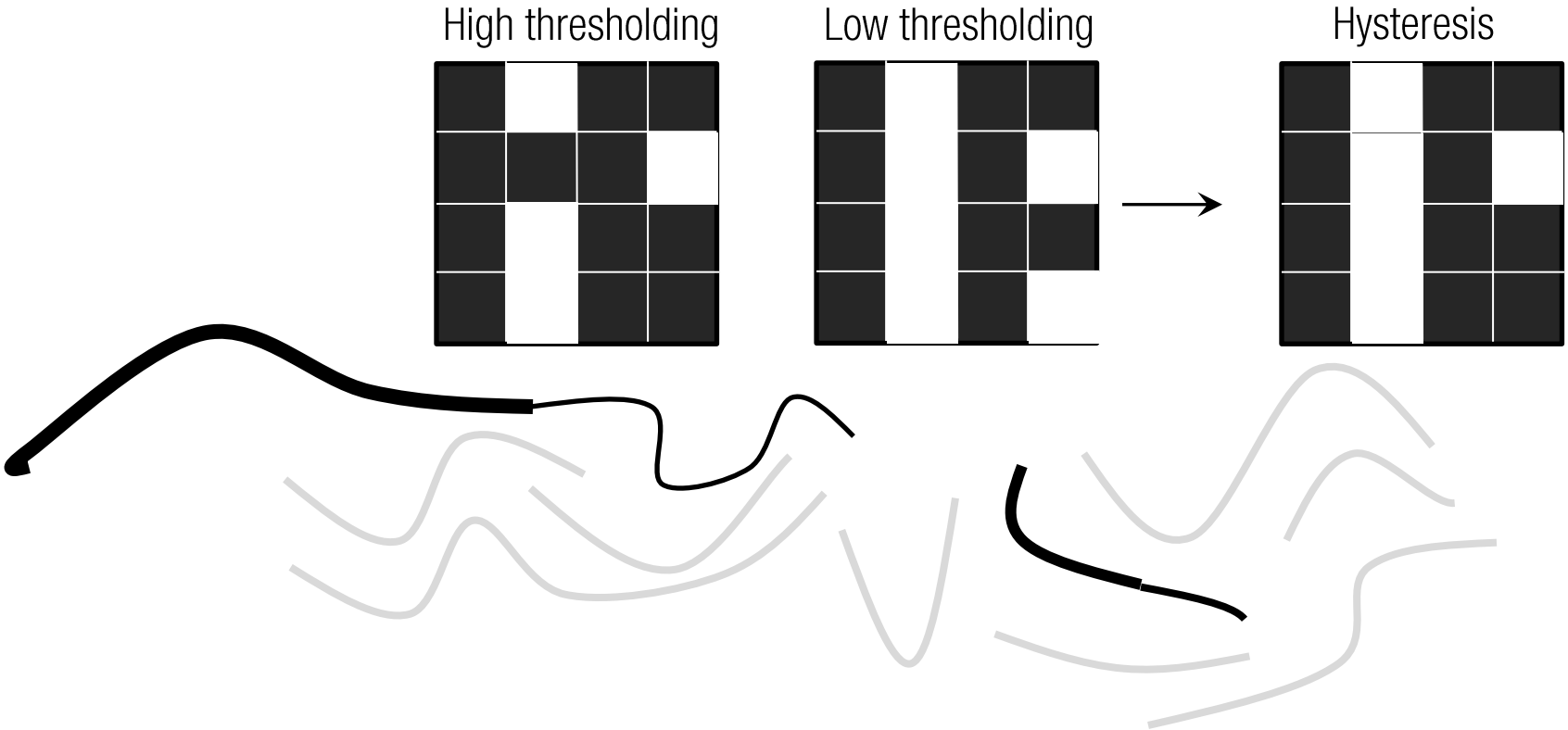
EDGE LINKING: HYSTERESIS

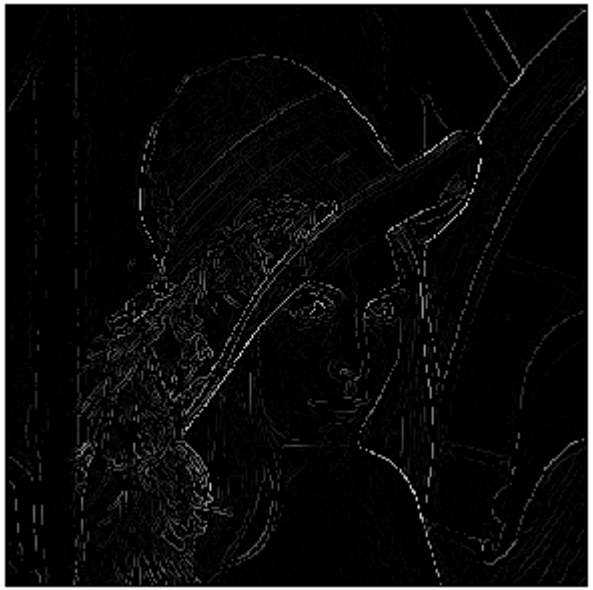


EDGE LINKING: HYSTERESIS



EDGE LINKING: HYSTERESIS

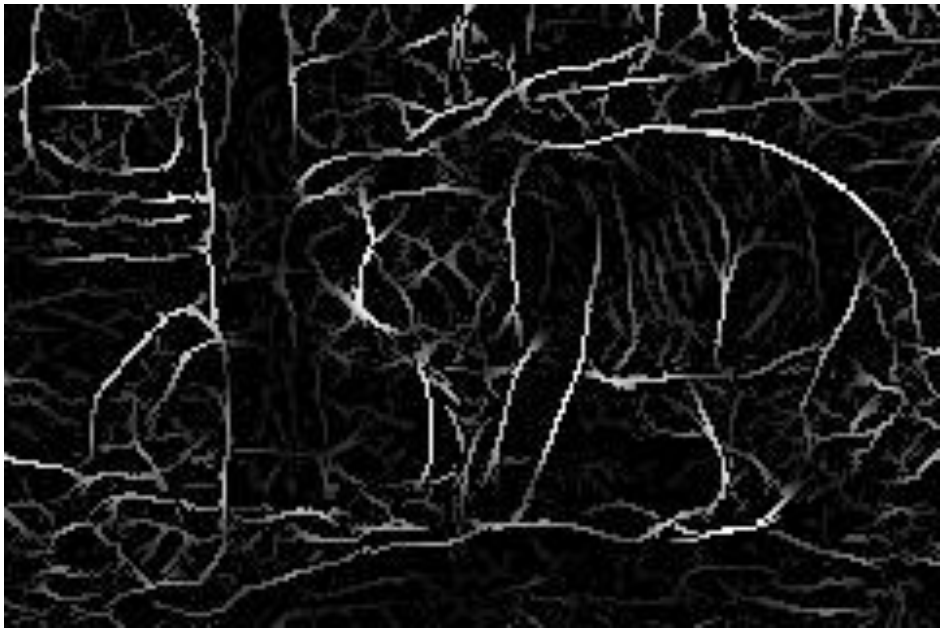




Localized edge

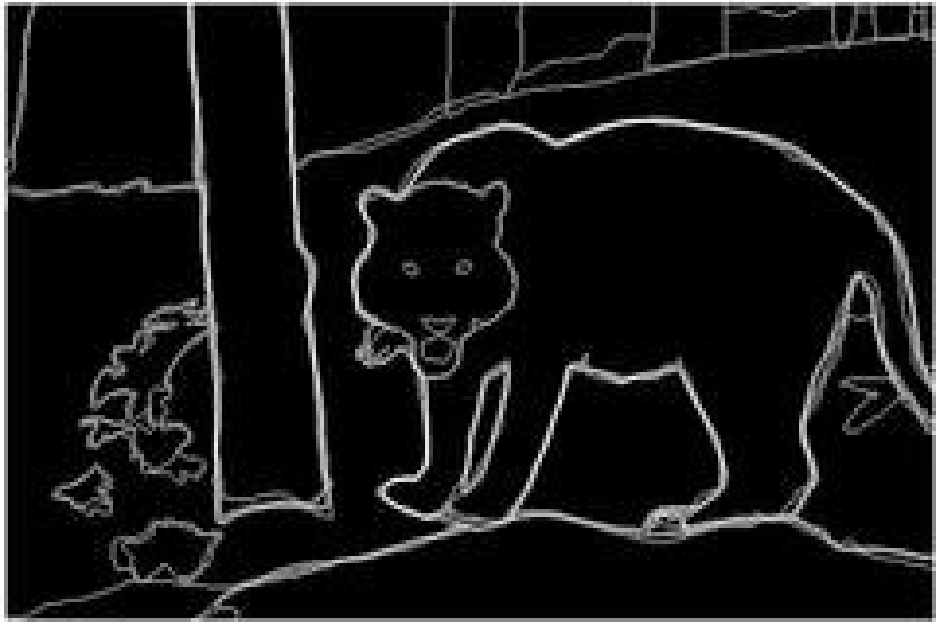
Edge linking

Is Edge Detector Solved?



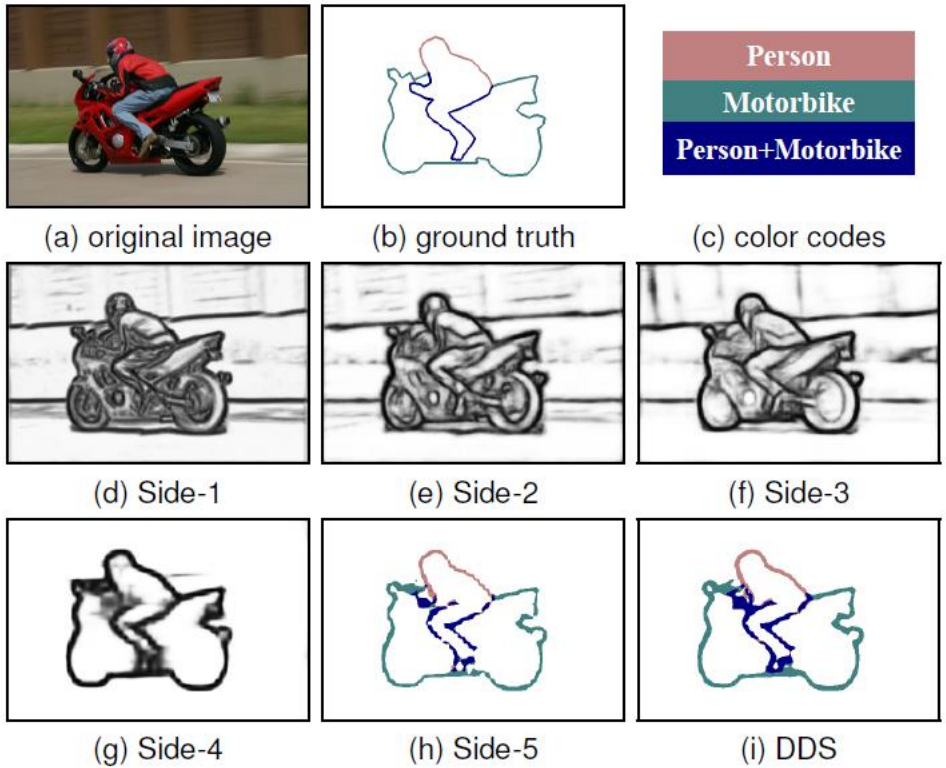
Canny edges

Is Edge Detector Solved?



Human perceived edges

SEMANTIC EDGES



Liu et al., “Semantic Edge Detection with Diverse Deep Supervision”, TPAMI (2018)

Liu et al., “Semantic Edge Detection with Diverse Deep Supervision”, TPAMI (2018)

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ShadowDraw

Real-Time User Guidance for Freehand Drawing

Yong Jae Lee
U. Of Texas at Austin

C. Lawrence Zitnick
Microsoft Research

Michael F. Cohen
Microsoft Research

SIGGRAPH 2011