Percolation

ISL

안재원

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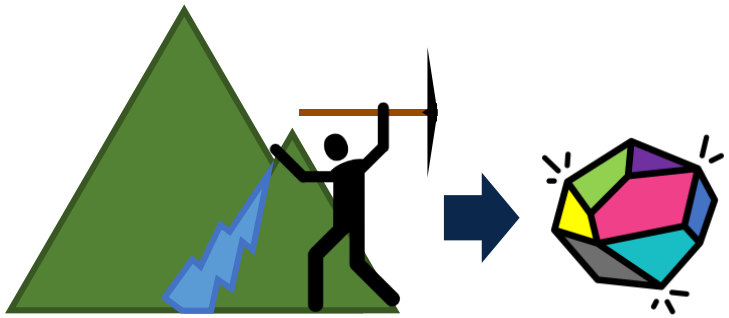
- Result

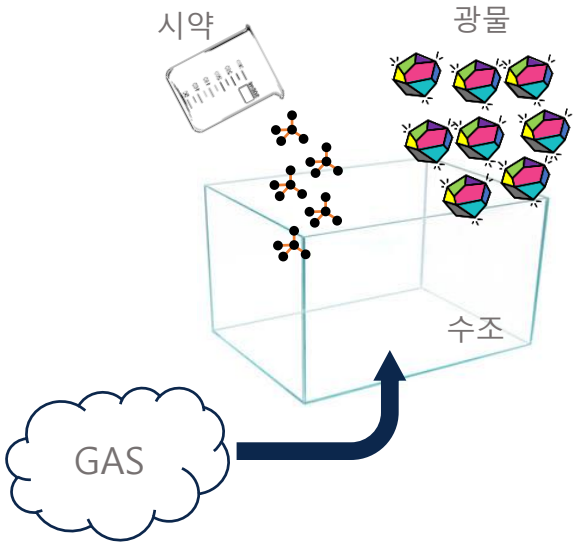
Intro

-과제 소개

KIGAM 한국지질자원연구원
Korea Institute of Geoscience and Mineral Resources

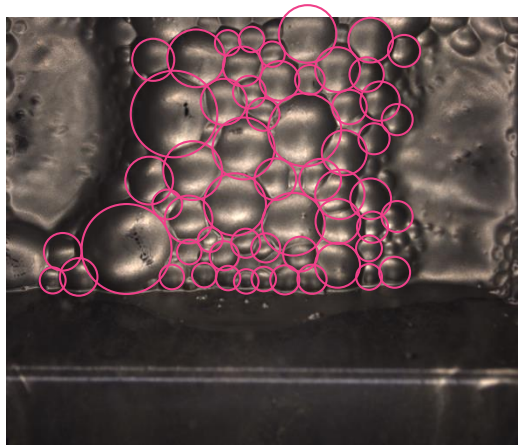
- Froth Flotation





- 육안으로 판별
- 시약과 광물의 양 조절
- 거품을 모아 목적 광물 획득

- 과제 목표

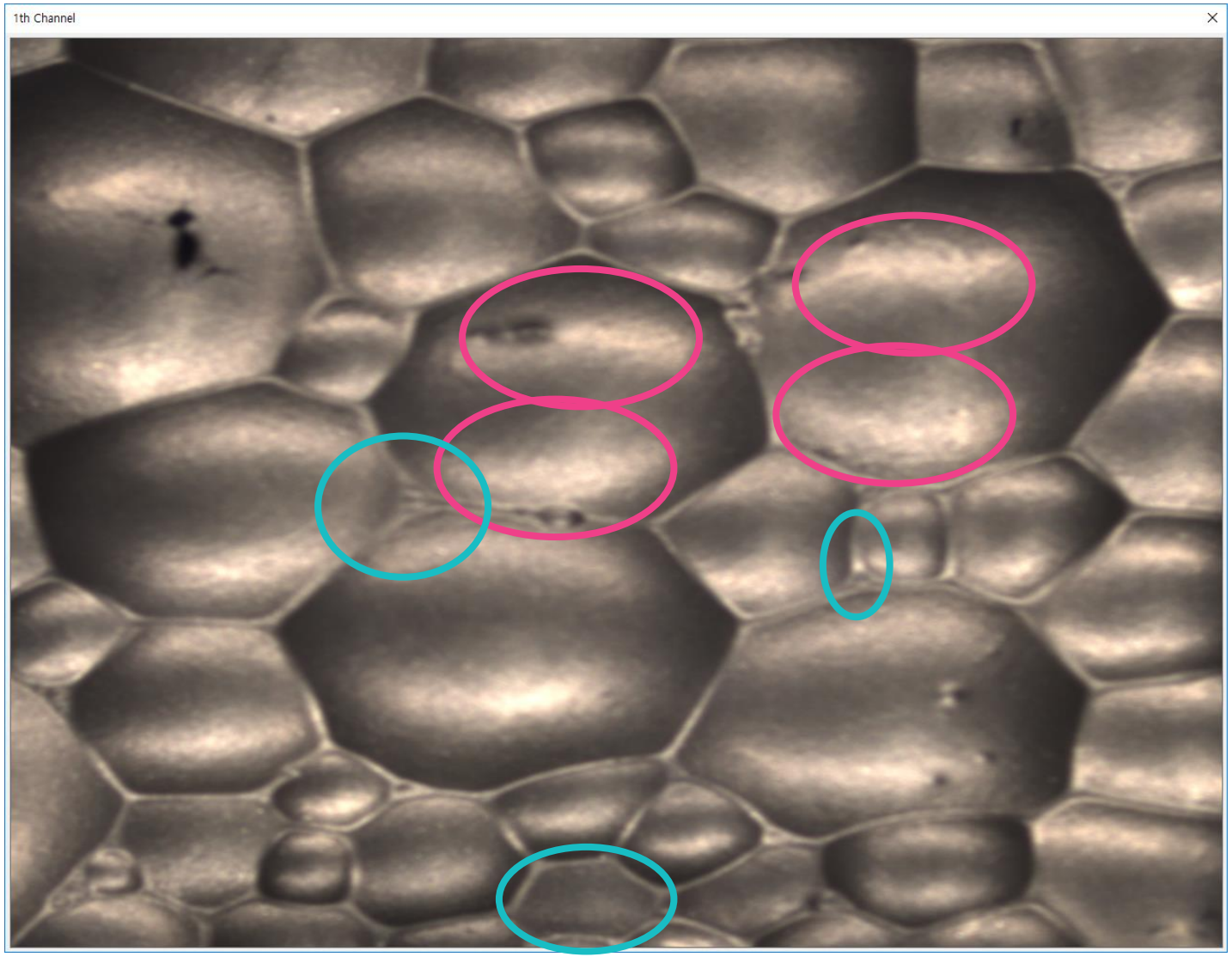


- 거품의 색상 정보 파악
- 거품의 정적 특성 파악
- 거품의 동적 특성 파악

- 거품 영역 분할 및 인식

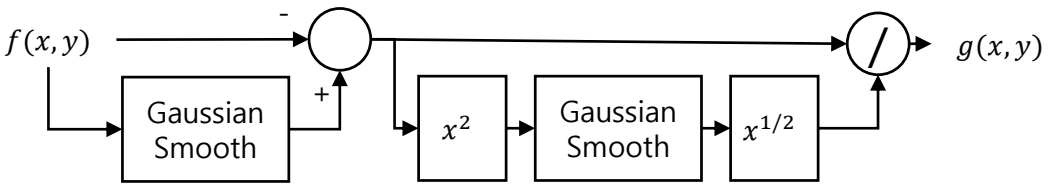
Intro

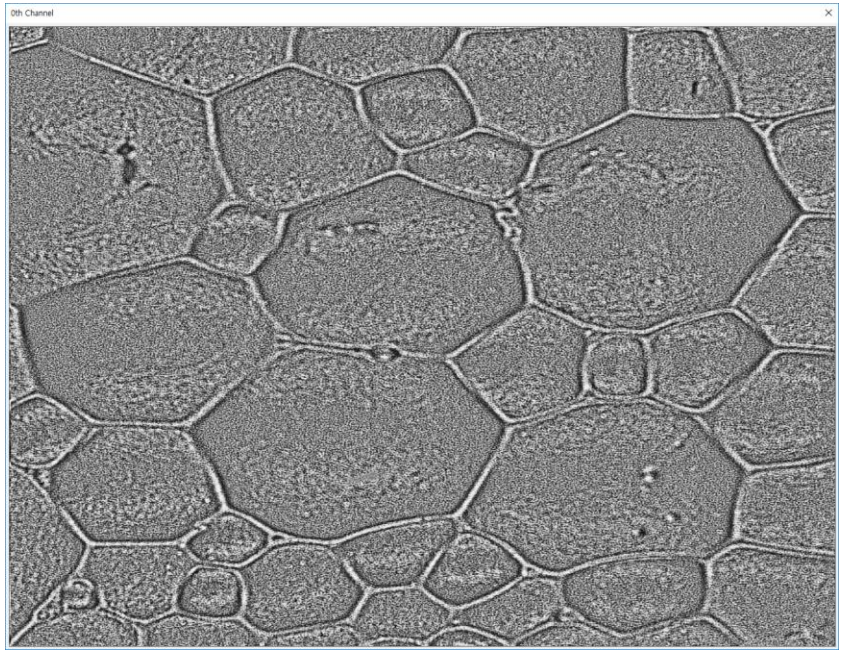
- *Problem*



- 각 거품 별 하이라이트 되는 영역의 수가 다르다.(Seed region)
- 거품이 아닌 영역에 seed가 잡힐 수 있다.
- 밝기 분포가 고르지 못하다.
- 기본적인 segmentation기법의 한계

※ Local Normalization





Percolation?

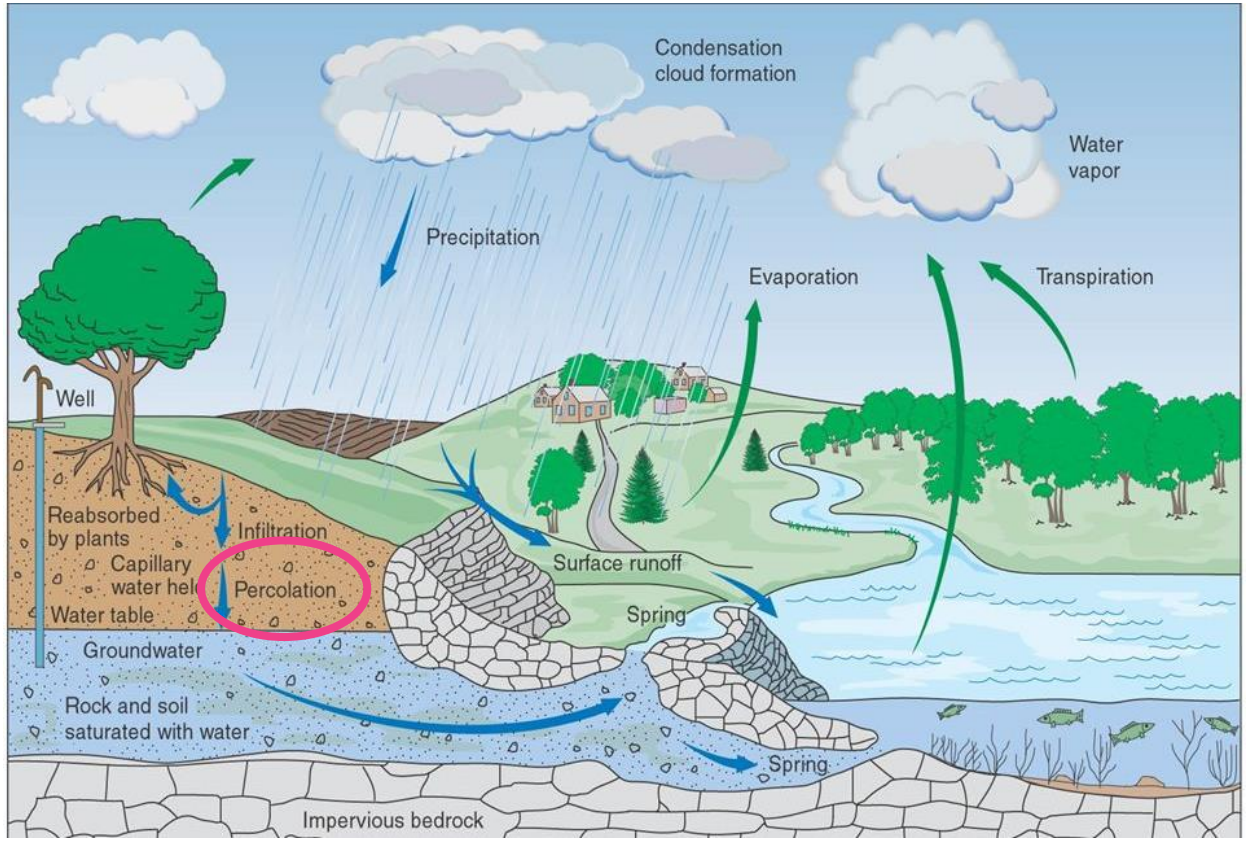
- *Percolation?*

- 화학 용어 사전

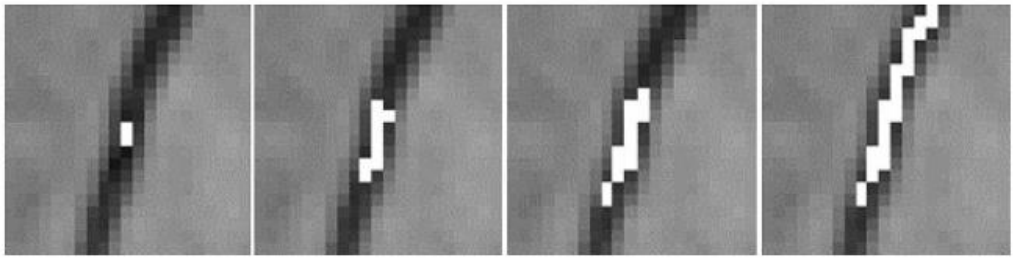
고체 입자의 충전층에 위쪽에서 액체를 흘려 고체 입자로부터 목적 성분의 추출, 액체 중의 이동성분의 흡착 또는 이온 교환, 유체와 충전층 입자 간의 축열식 열 교환 등을 하는 조작을 말한다.

- 물백과사전

물이 토양 속으로 스며들면 중력의 영향 때문에 지하로 이동하고 포화대까지 도달하게 되는데 이렇게 침투된 뒤 흙속에서 물이 아래쪽으로 이동하는 것을 침루라 한다



Examples of the percolation process



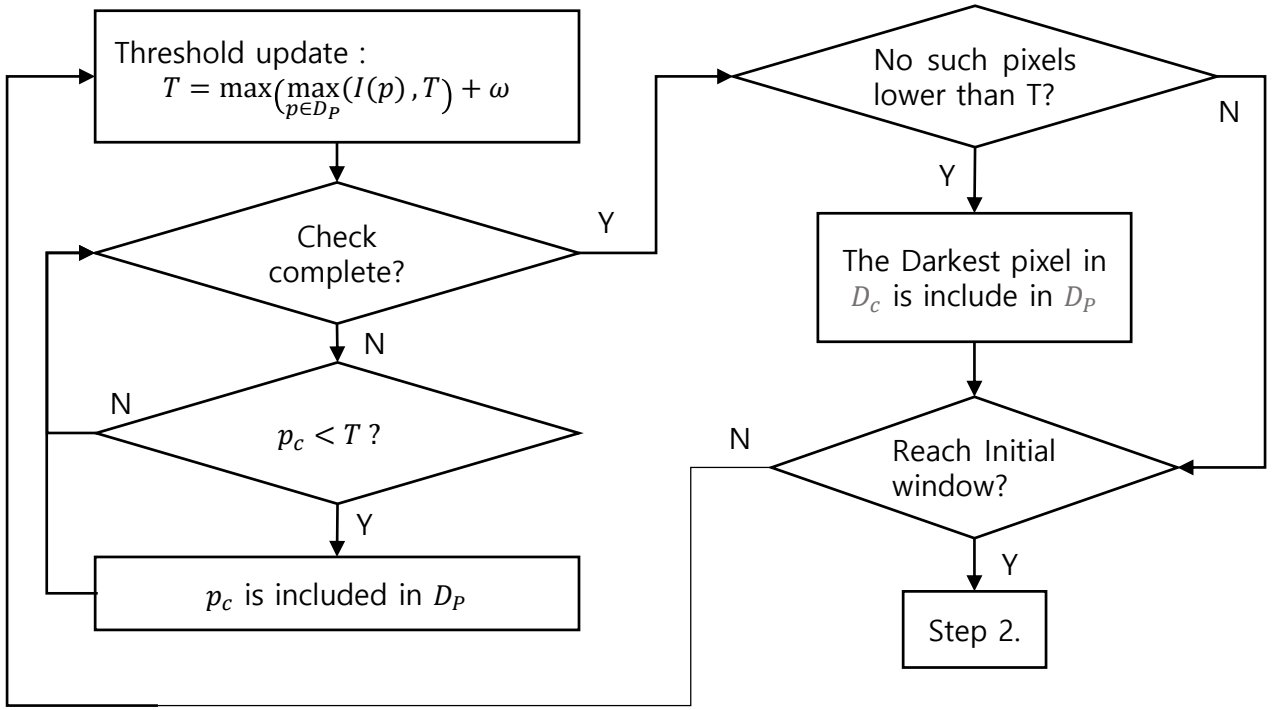
(1) Iteration 1 (2) Iteration 5 (3) Iteration 10 (4) Termination

Percolation?

- *Percolation*

Initial window size : N × N
Maximum window size : M × M
Initial pixel : p_s
Percolation region : D_P
Percolation threshold : T = I(p_s)
ω : acceleration parameter
D_c : the eight neighboring regions of D_P

- Step 1.



255	255	180	180	150	70	60
255	200	190	100	80	50	55
140	80	40	32	37	40	45
100	70	45	40	35	33	32
90	80	55	45	38	36	30
70	70	55	50	40	65	80
50	100	140	170	255	255	255

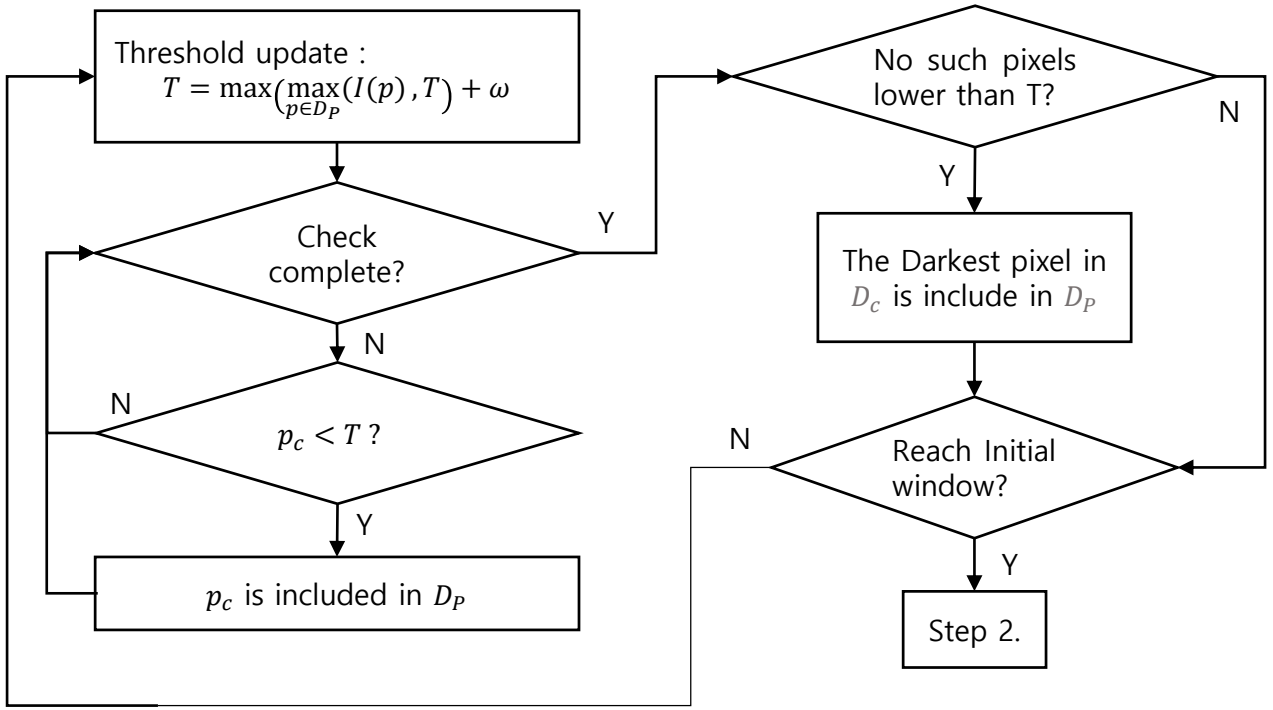
ω = 2, T = 42

Percolation?

- *Percolation*

Initial window size : N × N
Maximum window size : M × M
Initial pixel : p_s
Percolation region : D_P
Percolation threshold : T = I(p_s)
ω : acceleration parameter
D_c : the eight neighboring regions of D_P

- Step 1.



255	255	180	180	150	70	60
255	200	190	100	80	50	55
140	80	40	32	37	40	45
100	70	45	40	35	33	32
90	80	55	45	38	36	30
70	70	55	50	40	65	80
50	100	140	170	255	255	255

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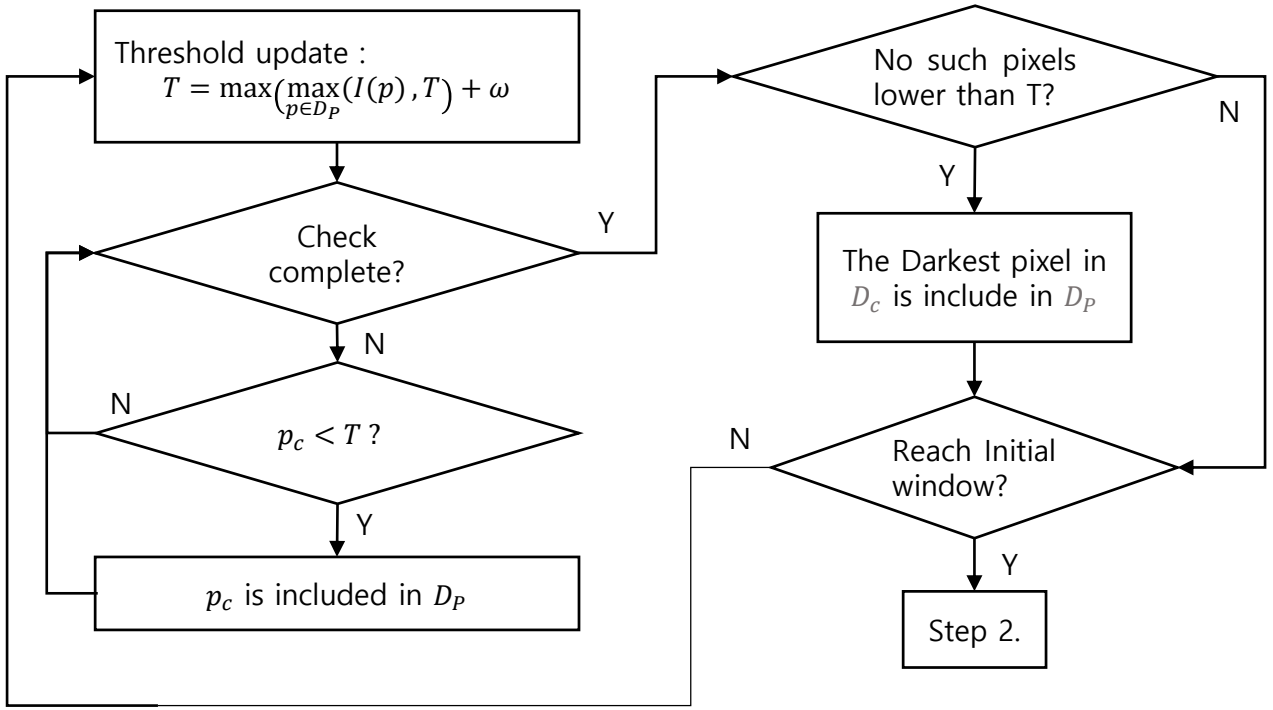
- Step 1.



255	255	180	180	150	70	60
255	200	190	100	80	50	55
140	80	40	32	37	40	45
100	70	45	28	35	33	32
90	80	55	45	38	36	30
70	70	55	50	40	65	80
50	100	140	170	255	255	255

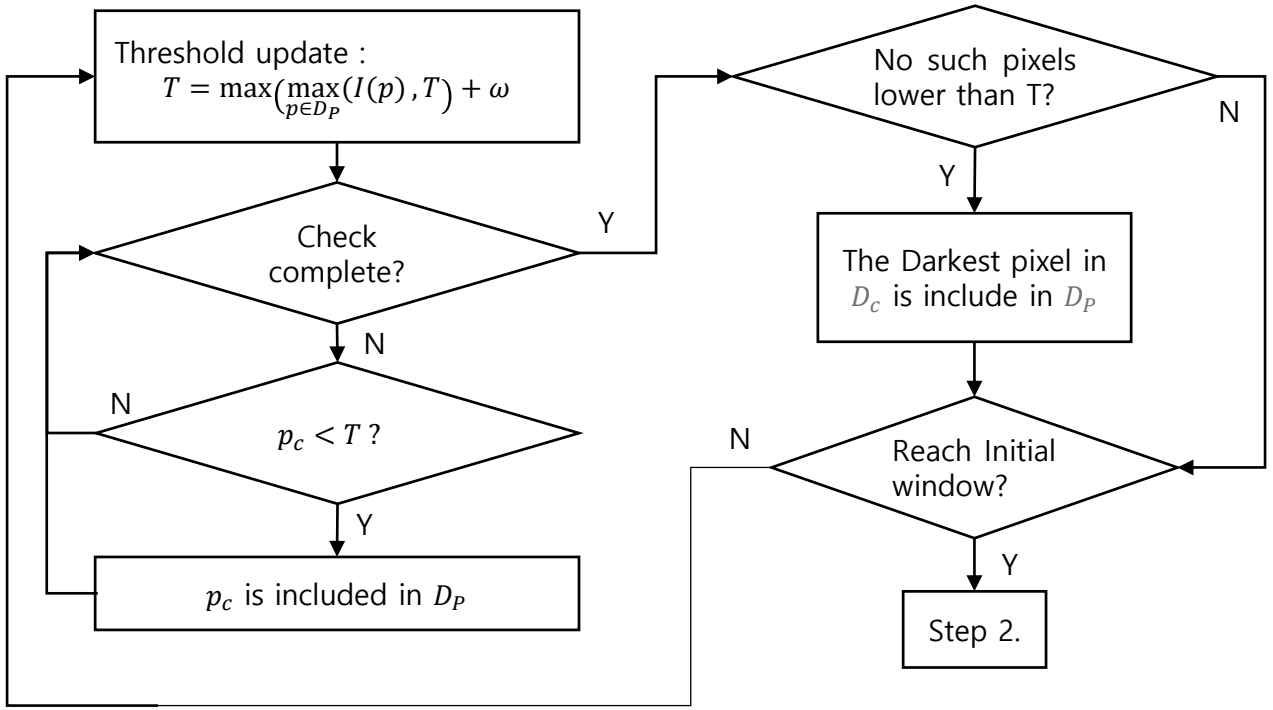
ω = 2, T = 30

Percolation?

- *Percolation*

Initial window size : N × N
Maximum window size : M × M
Initial pixel : p_s
Percolation region : D_P
Percolation threshold : T = I(p_s)
ω : acceleration parameter
D_c : the eight neighboring regions of D_P

- Step 1.



255	255	180	180	150	70	60
255	200	190	100	80	50	55
140	80	40	32	37	40	45
100	70	45	28	35	33	32
90	80	55	45	38	36	30
70	70	55	50	40	65	80
50	100	140	170	255	255	255

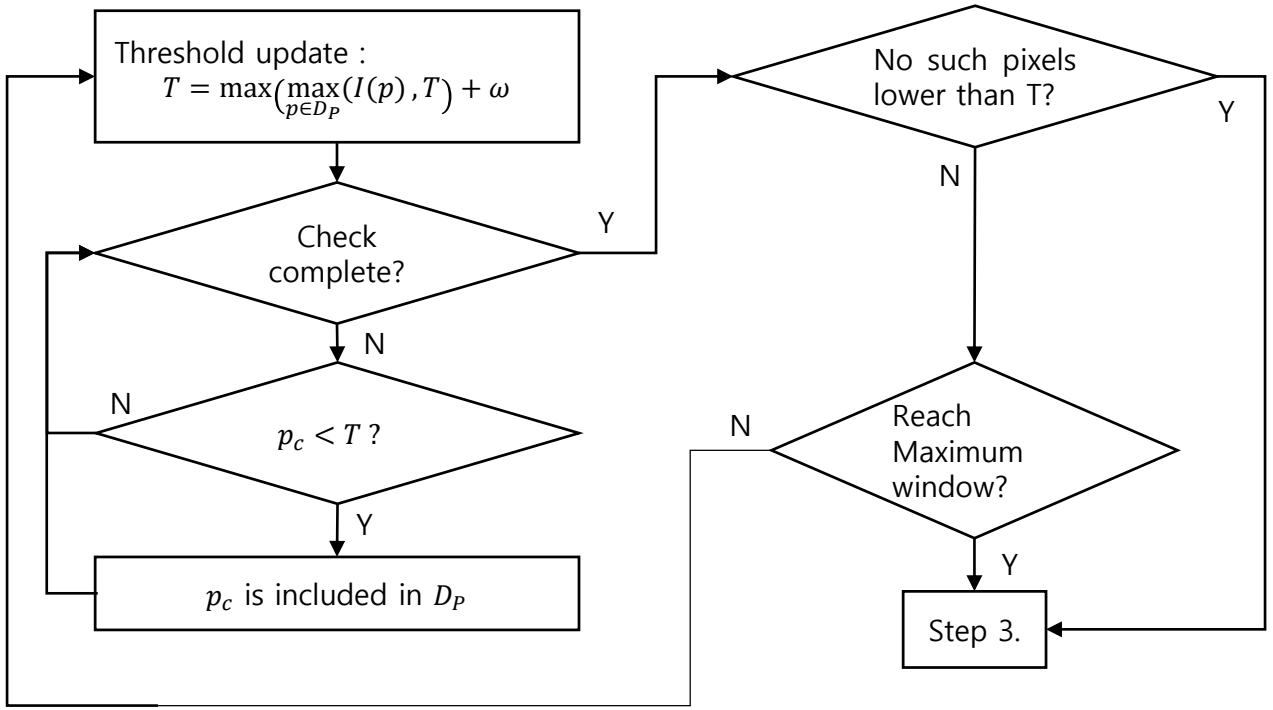
ω = 2, T = 30

Percolation?

- *Percolation*

Initial window size : N × N
Maximum window size : M × M
Initial pixel : p_s
Percolation region : D_P
Percolation threshold : T = I(p_s)
ω : acceleration parameter
D_c : the eight neighboring regions of D_P

- Step 2.



255	255	180	180	150	70	60
255	200	190	100	80	50	55
140	80	40	32	37	40	45
100	70	45	40	35	33	32
90	80	55	45	38	36	30
70	70	55	50	40	65	80
50	100	140	170	255	255	255

Percolation?

- *Percolation*

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Maximum window size : M × M
Initial pixel : p_s
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Percolation threshold : T = I(p_s)
ω : acceleration parameter
D_c : the eight neighboring regions of D_P

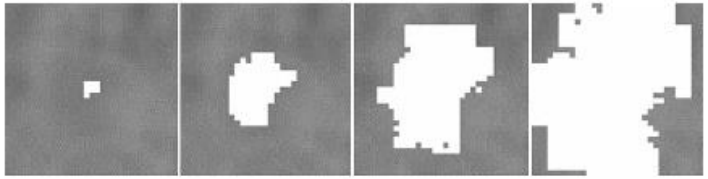
- Step 3.

Circularity : $F_C = \frac{4 \cdot C_{count}}{\pi \cdot C_{\max}^2}$ 0.866

C_{count} : The number of pixels in D_P 17

C_{max} : Maximum length of D_P 5

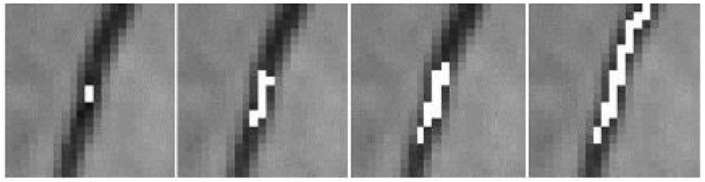
Close to 1 -> nearly circular



(1) Iteration 1 (2) Iteration 5 (3) Iteration 10 (4) Termination

(a) Background

Close to 0 -> nearly crack



(1) Iteration 1 (2) Iteration 5 (3) Iteration 10 (4) Termination

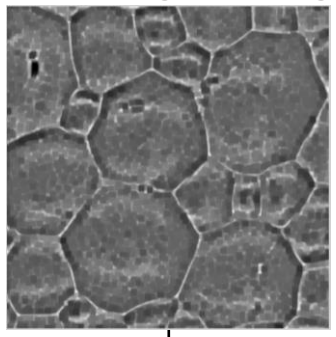
(b) Crack

255	255	180	180	150	70	60
255	200	190	100	80	50	55
140	80	40	32	37	40	45
100	70	45	40	35	33	32
90	80	55	45	38	36	30
70	70	55	50	40	65	80
50	100	140	170	255	255	255

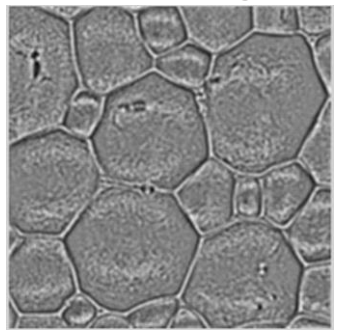
Result

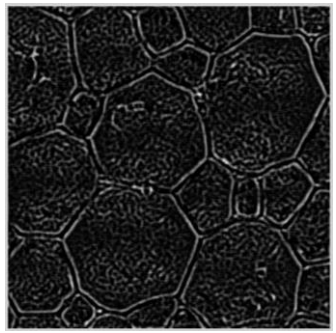
-Result

Morphological filtering



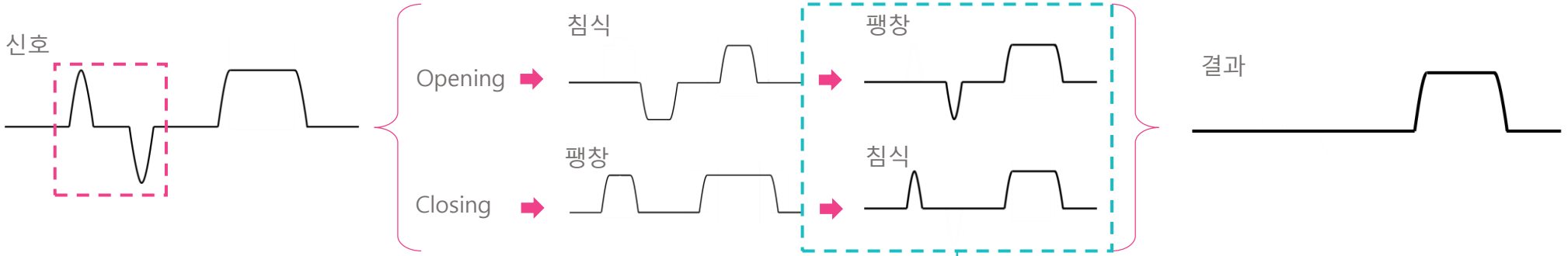
Gaussian filtering





Morphological filtering

경계를 훼손하지 않고 노이즈를 제거하기 위해 형태학적 필터(Morphological filter)를 사용한다. ≠ 가우시안 필터, 평균 필터 etc.



Morphological reconstruction(침식/팽창)

Reconstruction by erosion : $\delta_G^{(n)}(f) = \delta_G^{(1)}(\delta_G^{(n-1)}(f))$

Reconstruction by dilation : $\varepsilon_G^{(n)}(f) = \varepsilon_G^{(1)}(\varepsilon_G^{(n-1)}(f))$

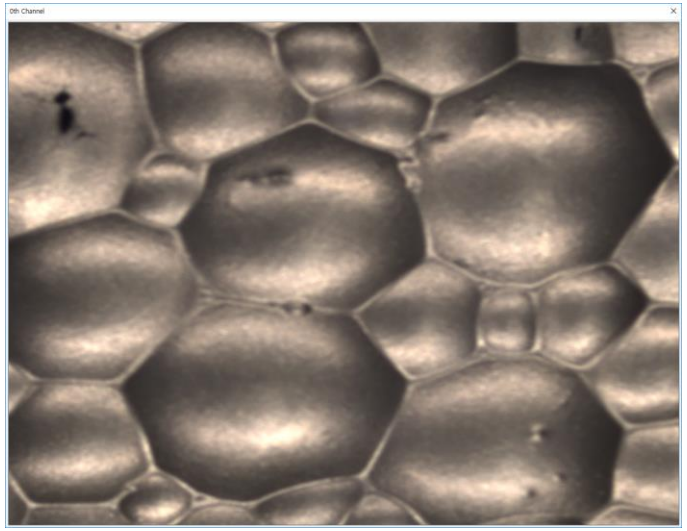
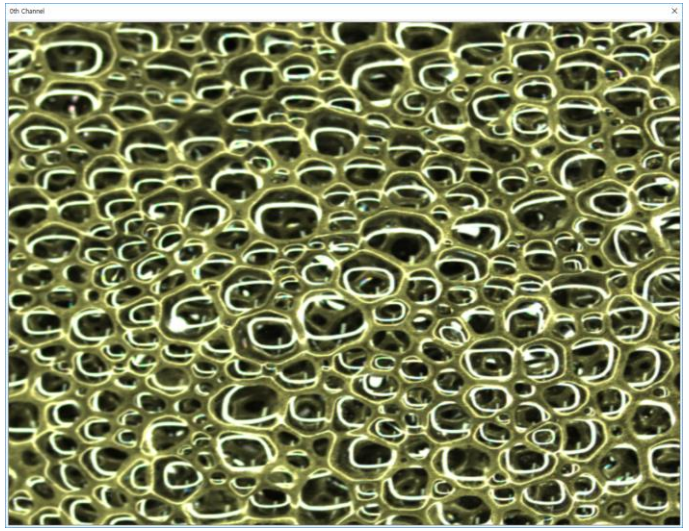
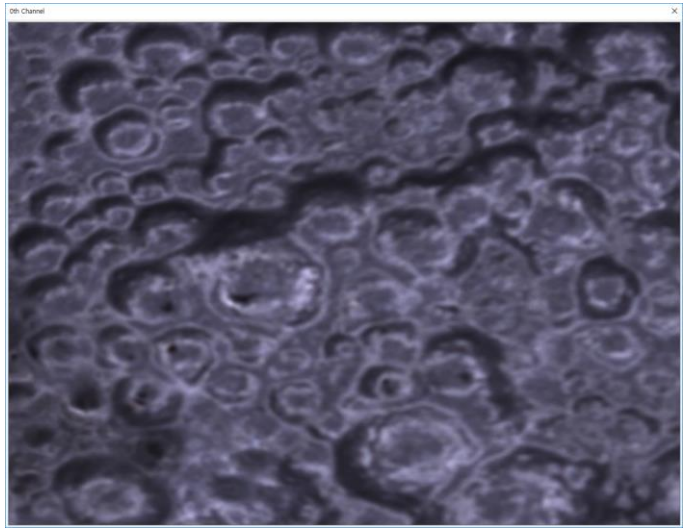
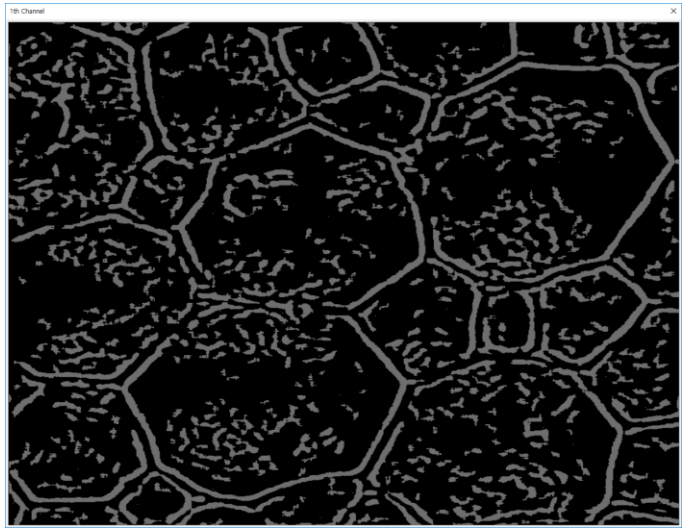
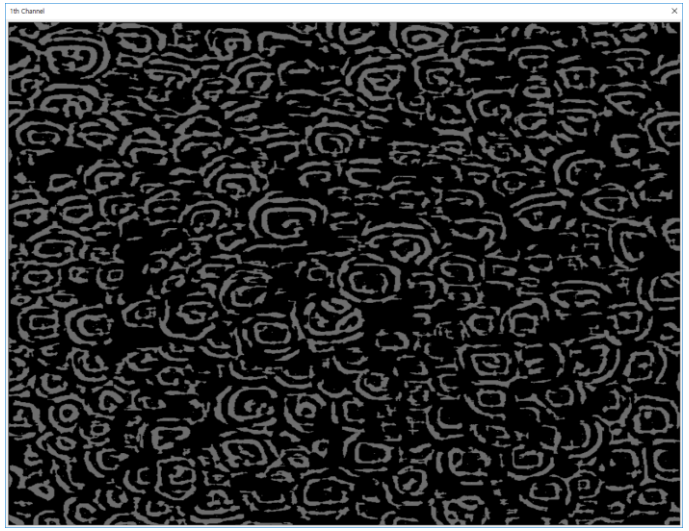
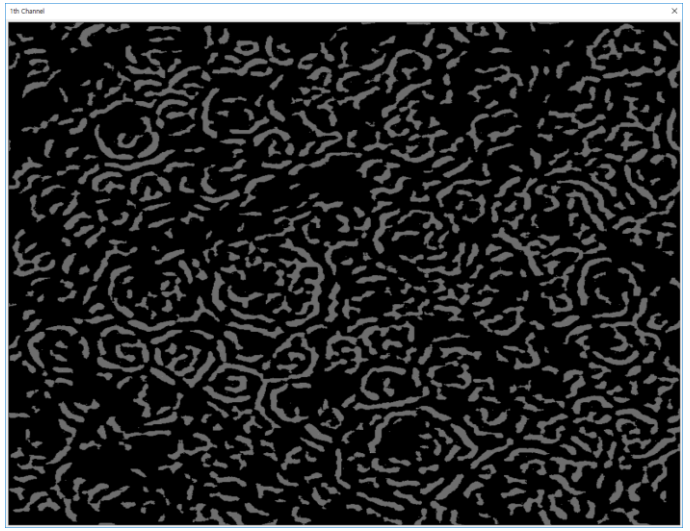
Geodesic Erosion/Dilation

Geodesic erosion : $\varepsilon_G^{(1)}(f) = (f \ominus B) \cup G$

Geodesic dilation : $\delta_G^{(1)}(f) = (f \oplus B) \cap G$

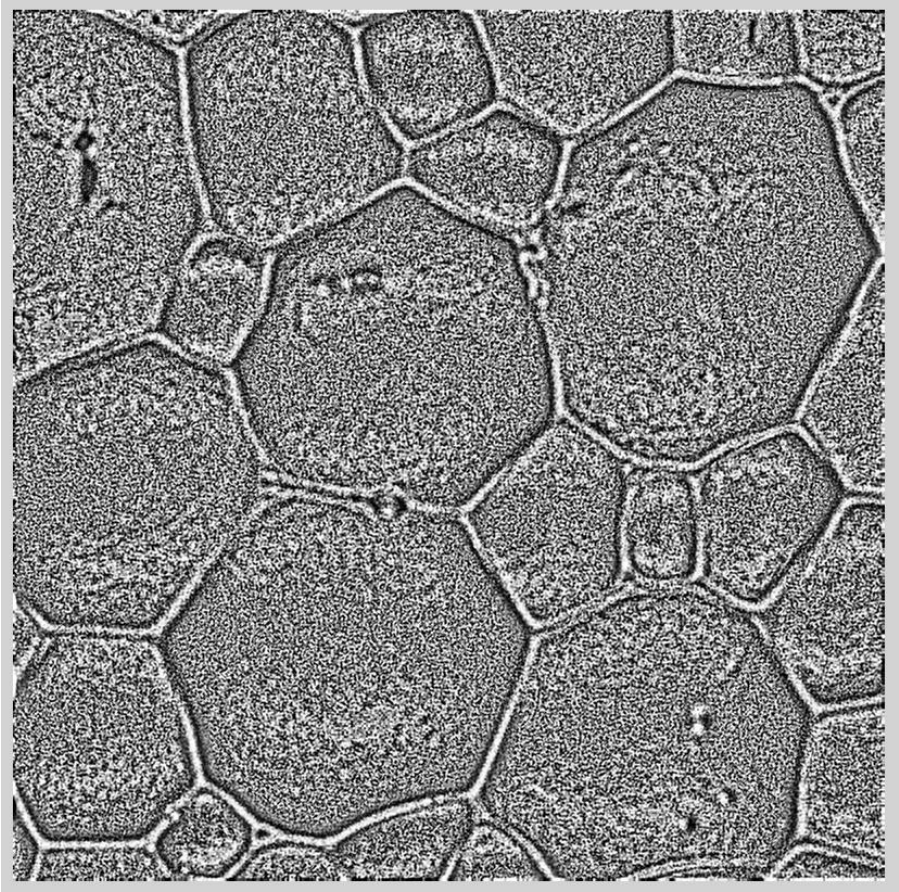
Result

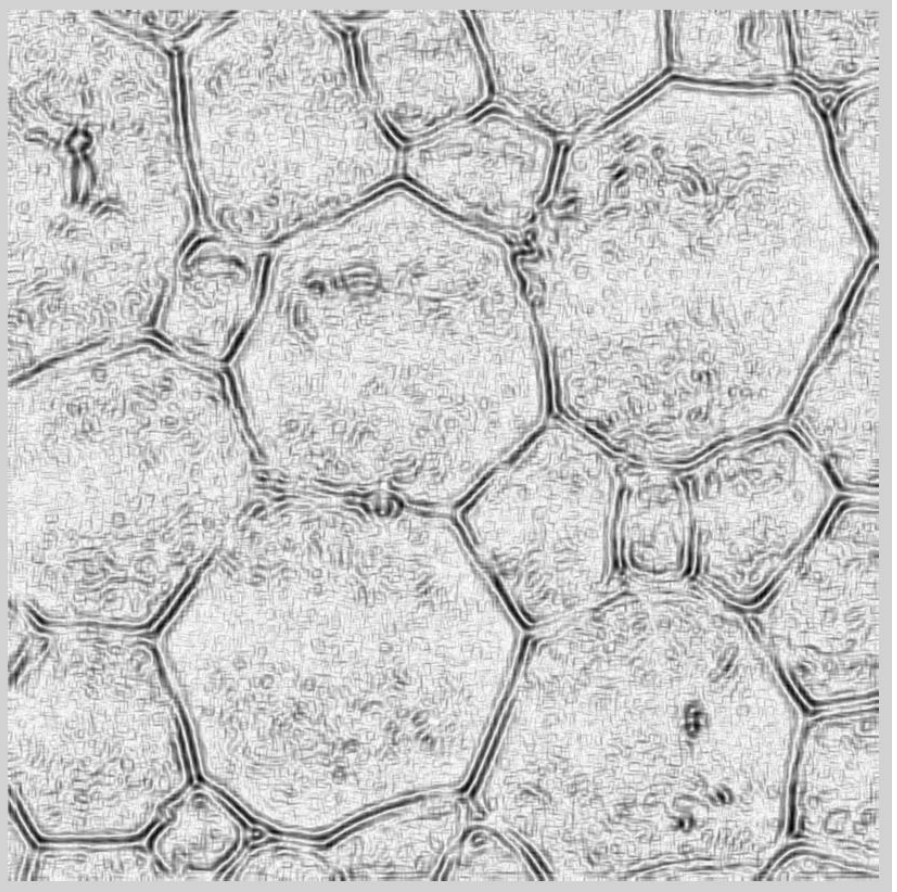
-Result

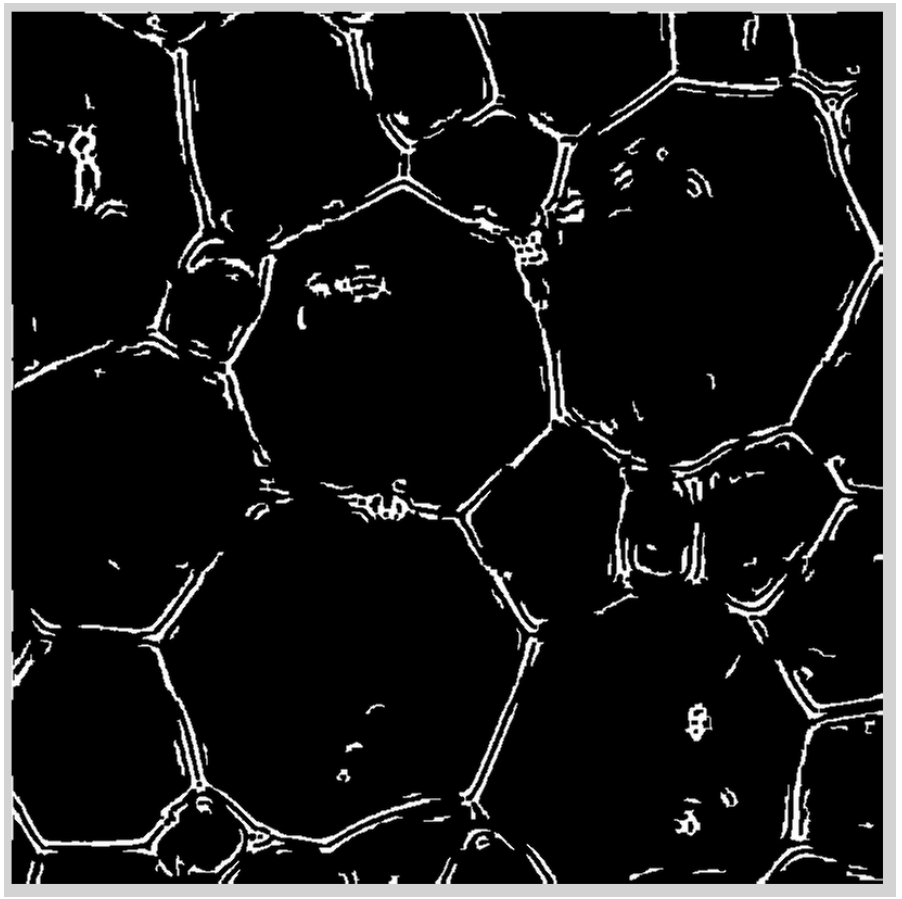
Q & A

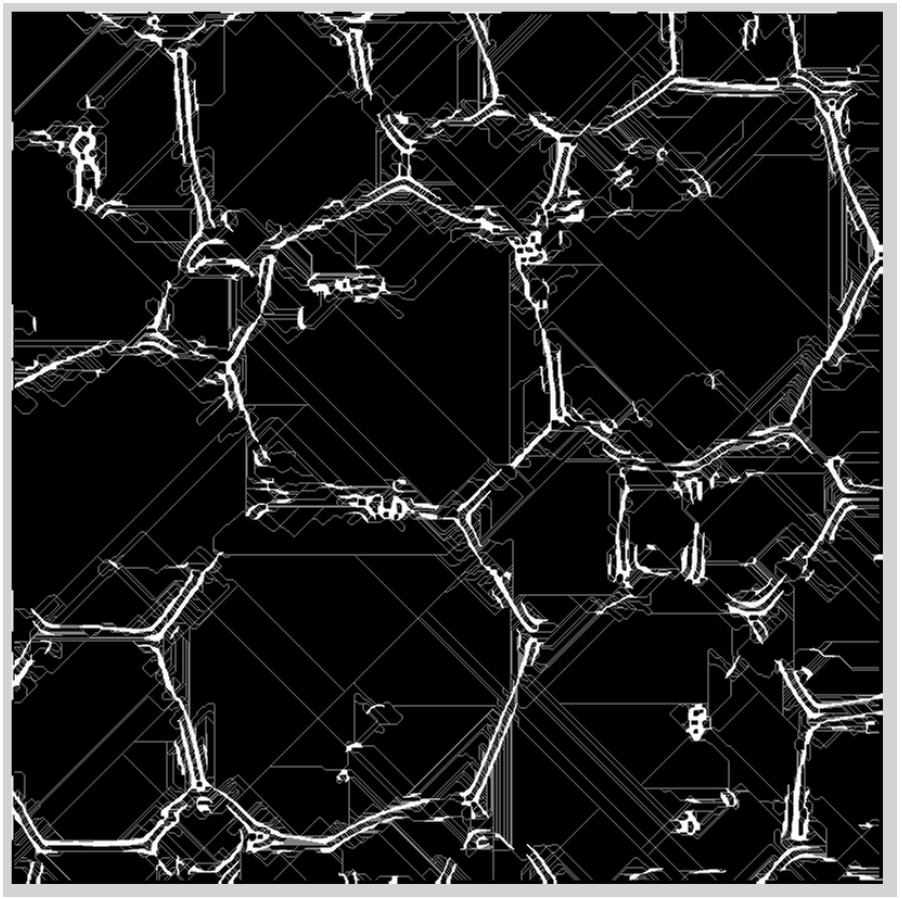
Etc.





Etc.





Etc.