2019-04-10

OpenCV를 이용한 Segmentation

ISL

안재원

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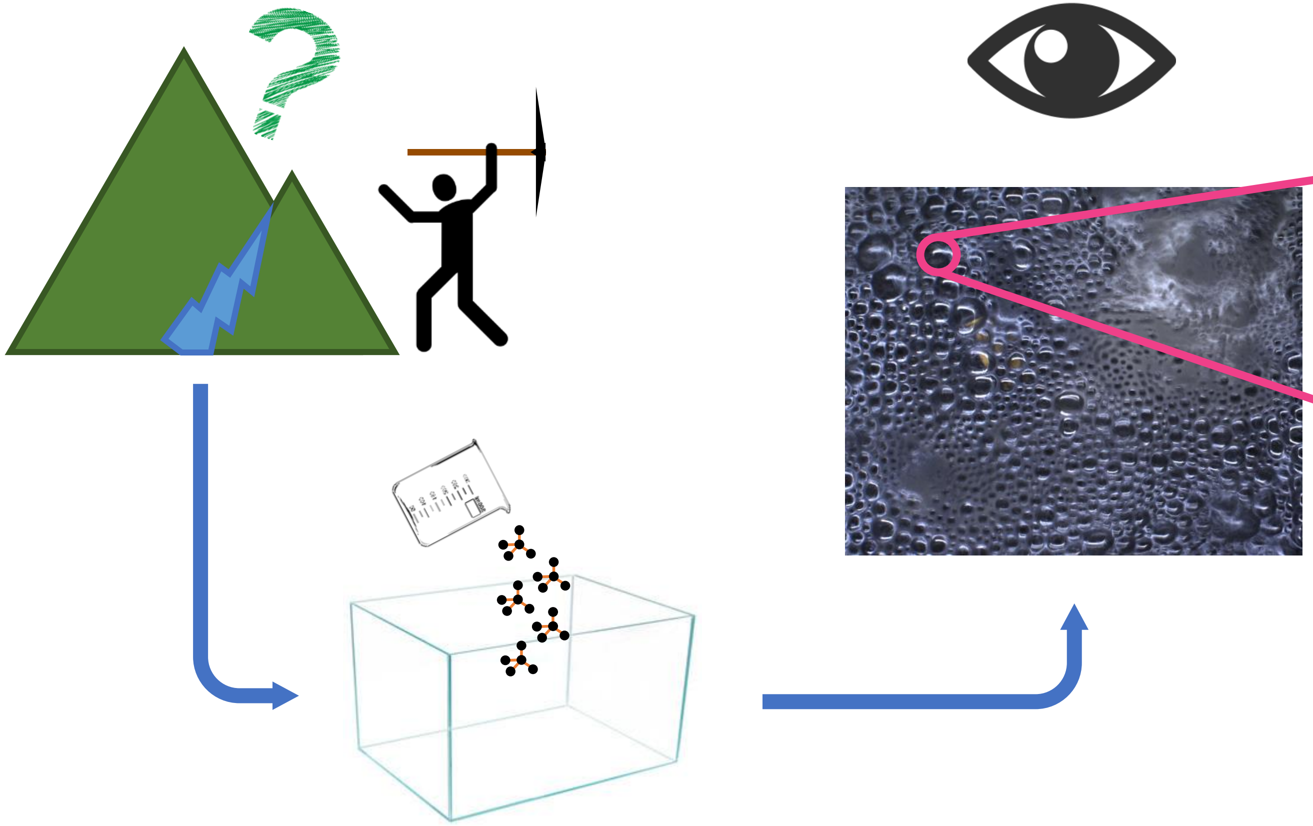
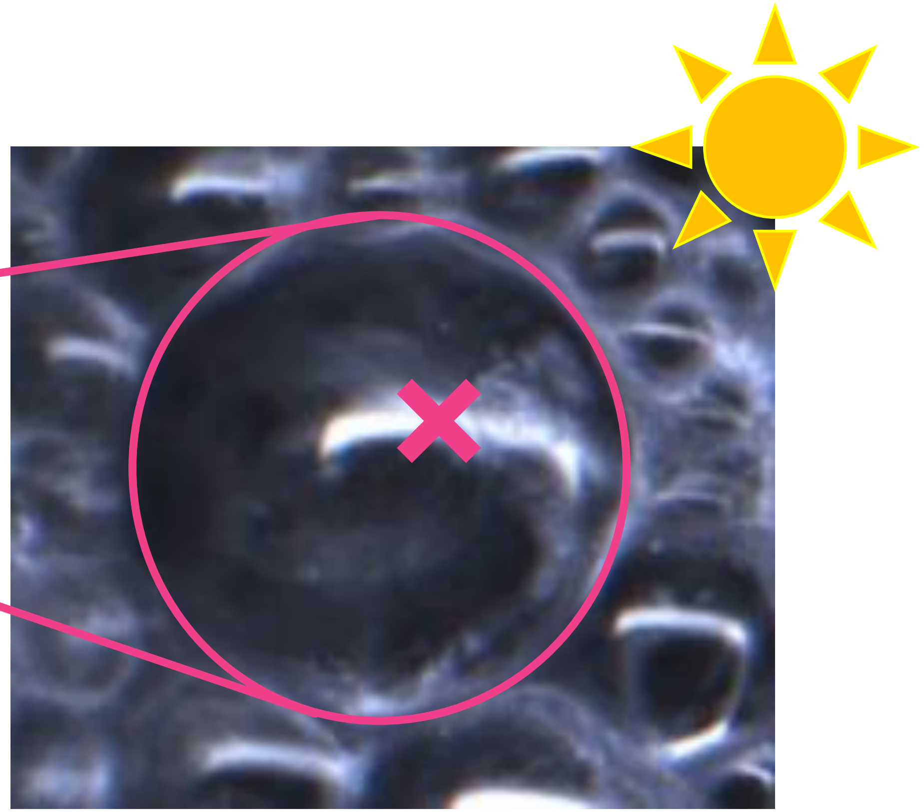
Intro

-과제 소개

KIGAM 한국지질자원연구원
Korea Institute of Geoscience and Mineral Resources

- 과제의 목적





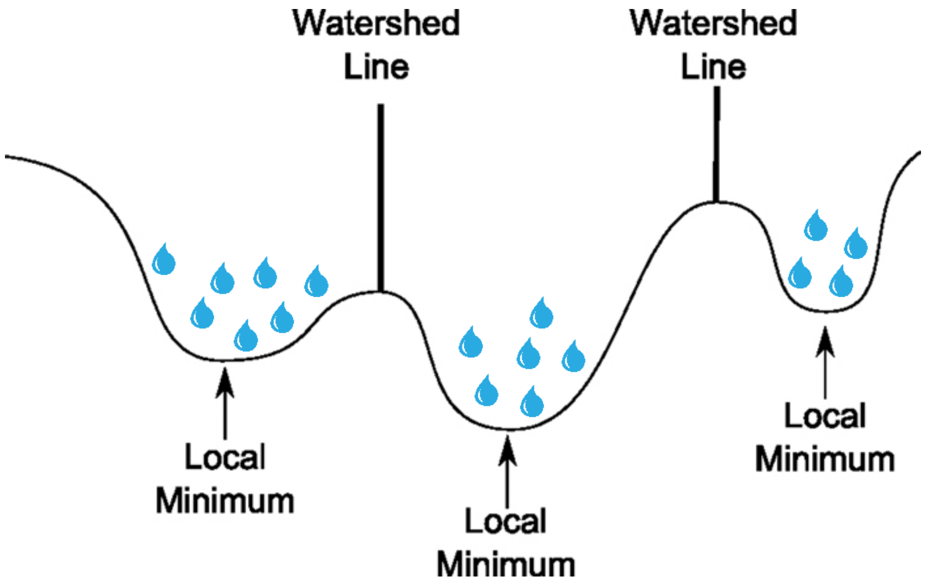
- 방울 검출
- 노이즈 제거
- 방울 색상 분석

Watershed

-Watershed

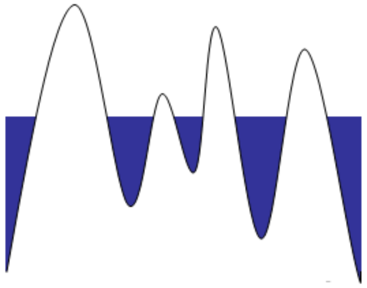
원본 영상

기울기 영상

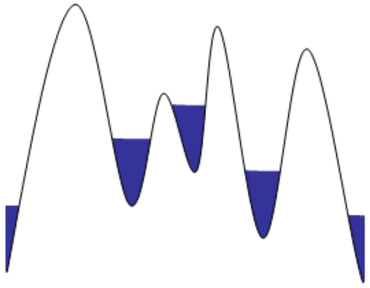


기울기 기반의 고도 정보

- Watershed의 종류



담금 방식



강우 방식

- 담금 방식 : 계곡에 밑에서 부터 물이 차오르는 방식
- 강우 방식 : 물이 위에서 떨어져 영역이 확장되는 방식

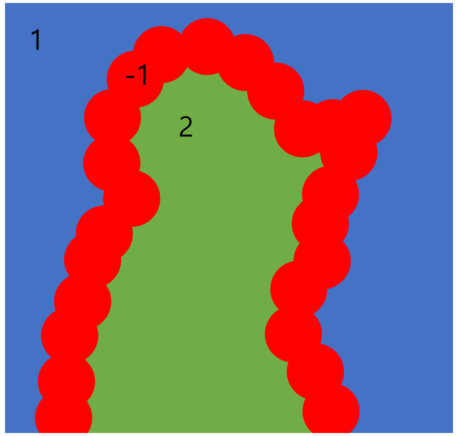
- 병합과 분할의 시점에 따라 다르다.

Watershed

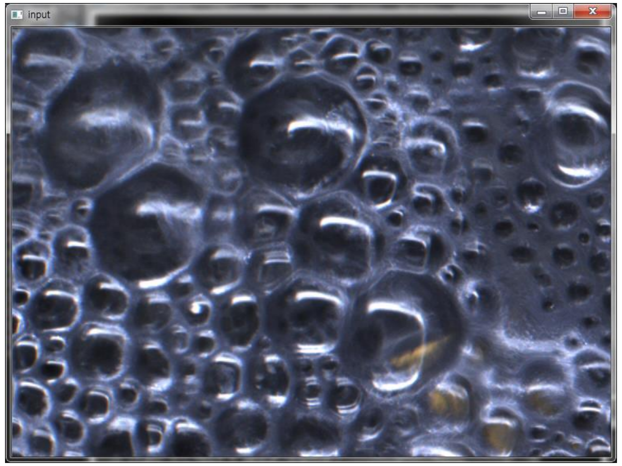
-cv::watershed(InputArray image, InputOutput Array)

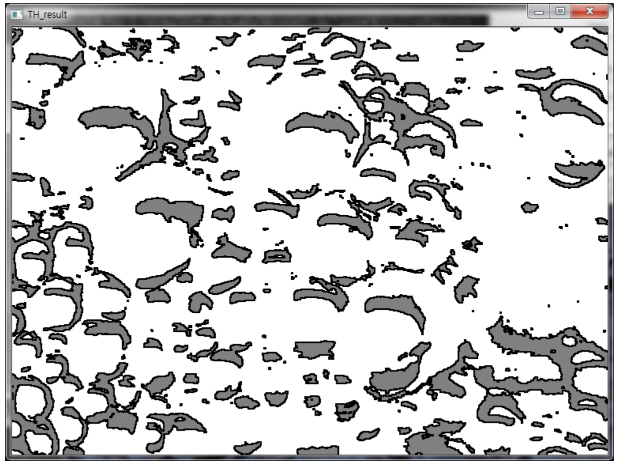
→ 원본 영상 → Seed(Marker) 영상 & 결과 영상

- Seed 영상(32-bit 1-channel Imaeg)
  Rough한 분할 정보를 저장



- OpenCV의 Watershed는 강우 방식 기반.
- 기준 영역은 양수 값을 부여.
- 경계 영역(미 지정 영역)은 -1을 부여.

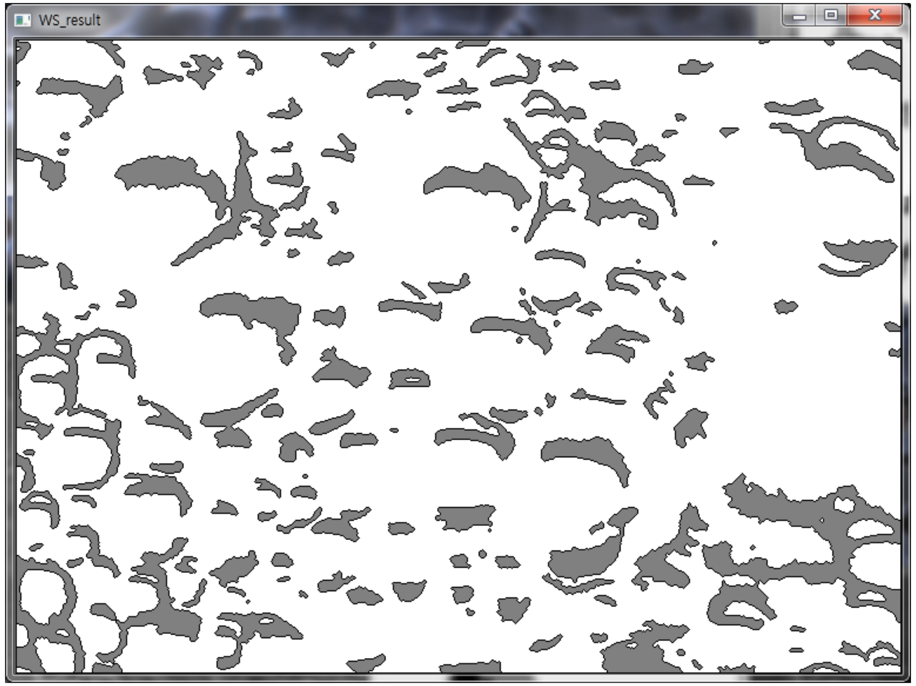




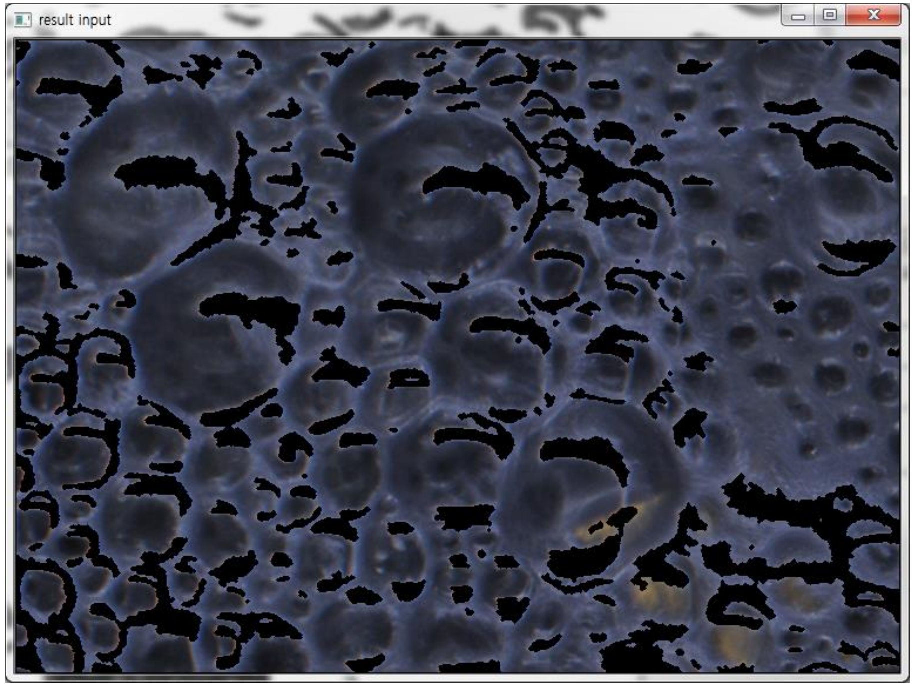
- 밝기 값을 이용해 기준 영역 선정.
- 기준 영역은 흰색과 회색.
- 경계 영역은 검정색.

Watershed

-cv::watershed(InputArray image, InputOutput Array)



- Watershed 결과

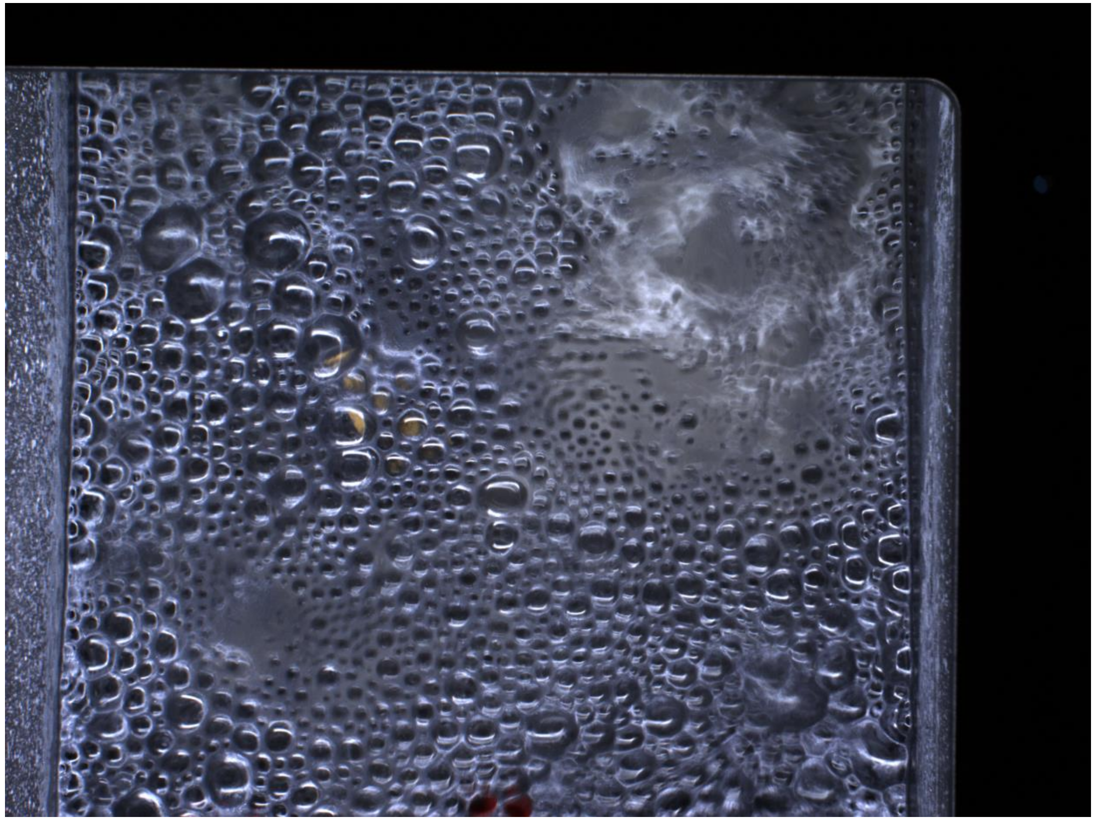


- 회색 영역을 제거한 결과

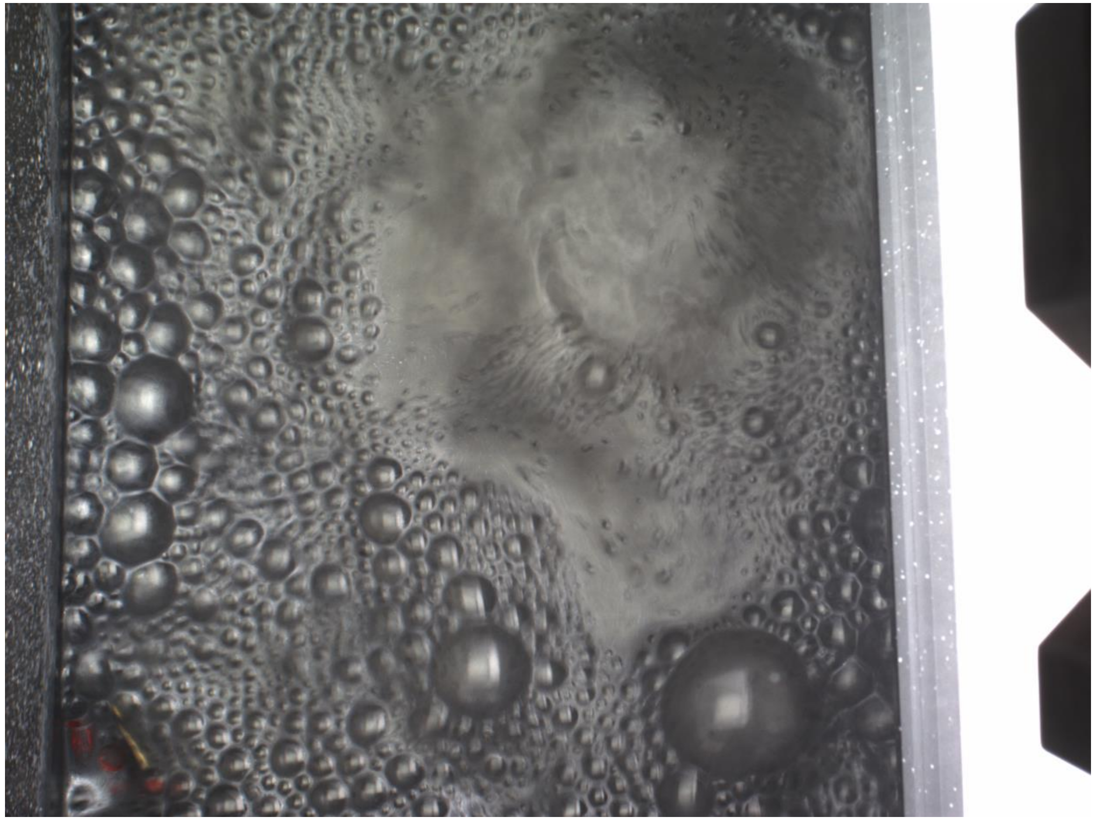
Watershed

-Problem

- 기준의 모호함



Test set #1

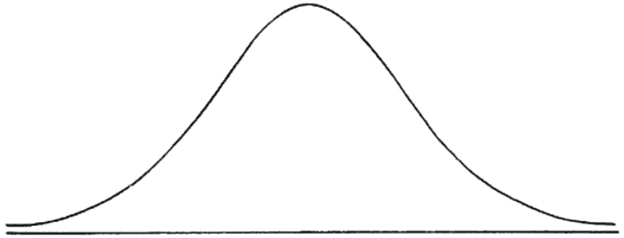


Test set #2

GMMs

-Gaussian Mixture Models

- 정규 분포 모델



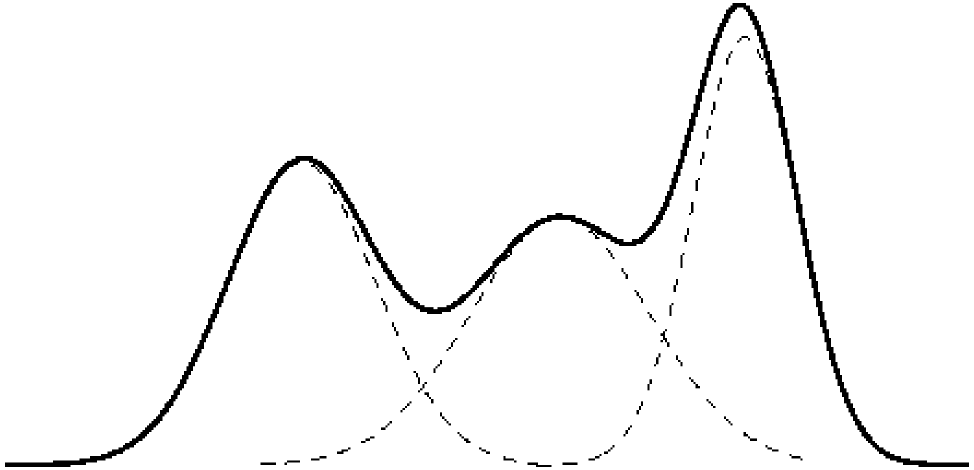
- 평균 μ와 분산 σ를 갖는 분포
- 독립적인 자연계의 사건은 정규 분포 형태를 따르는 경우가 많음.

거품 영상

색상 공간 변환

- 정규 분포 혼합 모델

여러 정규 분포 데이터가 모인 형태



H Channel 히스토그램

GMMs

최우추정법

- 정규 분포 혼합 모델

$$p(x|\theta)=\sum_{j=1}^{M} p(x|\omega_j)P(\omega_j)$$

$$P(\omega_j)=\alpha_j \qquad 0\le\alpha_j\le 1 \qquad \sum_{j=1}^{M}\alpha_j=1$$

$$p(x|\omega_j)=\frac{1}{\sqrt{2\pi}\sigma_j}\exp\left(-\frac{(x-\mu_j)^2}{2\sigma_j^2}\right)$$

$$\theta=\{\{\omega\cdots\},\{\alpha\cdots\}\}$$
$$\omega=\{\{\mu\cdots\},\{\sigma\cdots\}\}$$

- 로그 우도(log-likelihood)

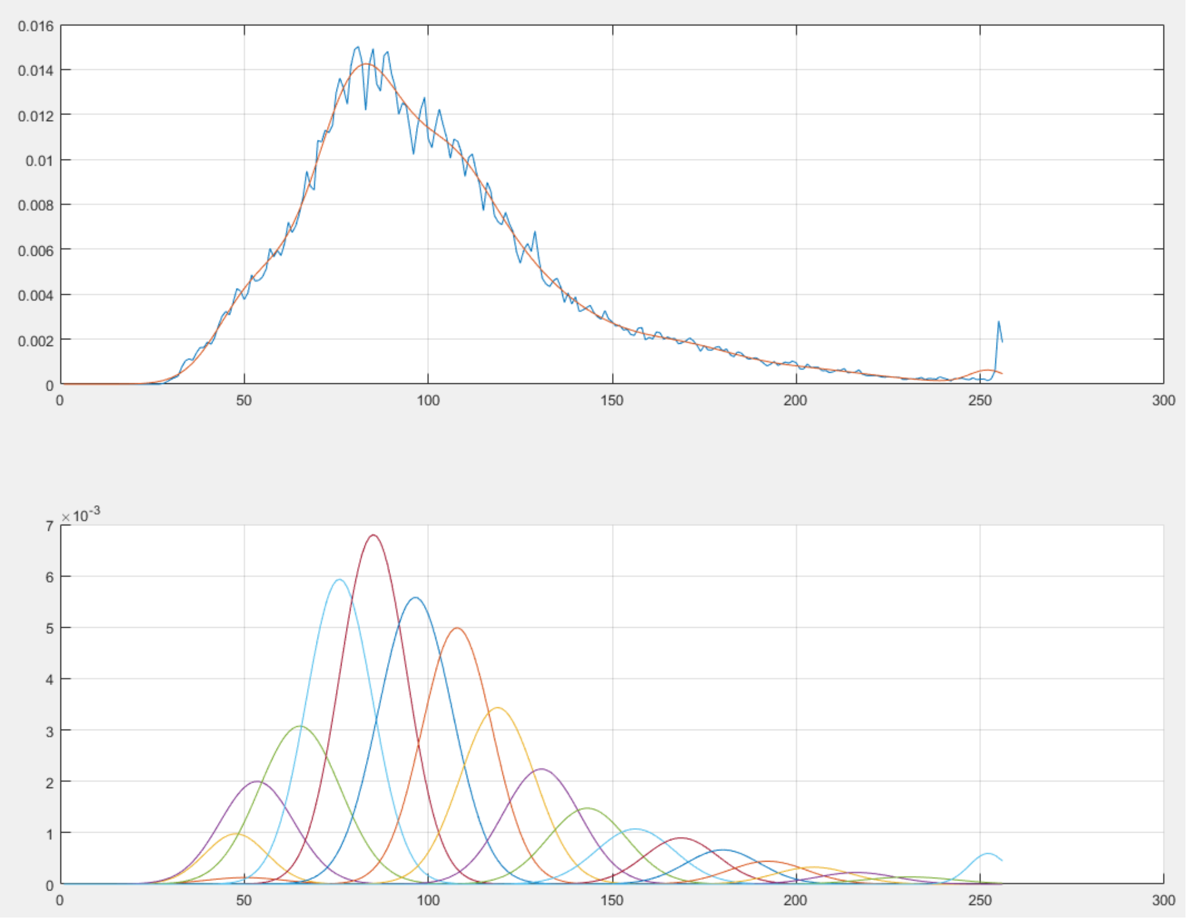
$$E=-\sum_{n=1}^{N}\log p(x_n|\theta)$$

$$\hat{\mu}_j=\frac{\sum_{n=1}^{N}P(\omega_j|x_n)x_n}{\sum_{n=1}^{N}P(\omega_j|x_n)}$$

$$\hat{\sigma}_j^2=\frac{\sum_{n=1}^{N}P(\omega_j|x_n)\|x_n-\mu_j\|^2}{\sum_{n=1}^{N}P(\omega_j|x_n)}$$

$$\hat{\alpha}_j=\frac{1}{N}\sum_{n=1}^{N}P(\omega_j|x_n)$$

$$P(\omega_j|x_n)=\frac{p(x_n|\omega_j)\alpha_j}{p(x_n|\theta)}$$



$j=20$

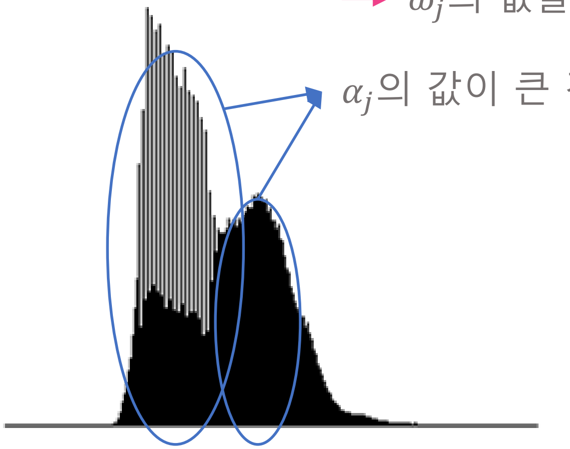
GMMs

Seed 선정

$$p(x|\theta)=\sum_{j=1}^{M}p(x|\omega_j)P(\omega_j)$$

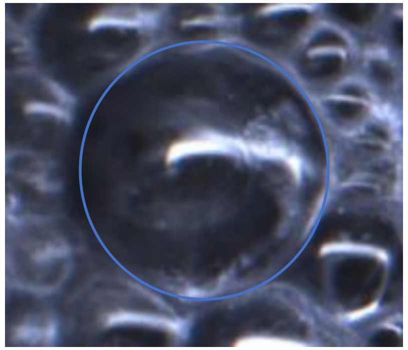
$0 \le \alpha_j \le 1 \quad \sum_{j=1}^{M}\alpha_j = 1$

ω_j의 값을 사용하는 정규 분포의 상대적 중요도.

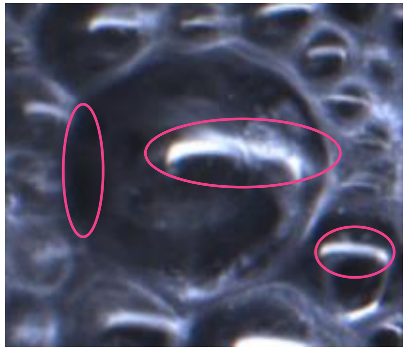


L Channel 히스토그램

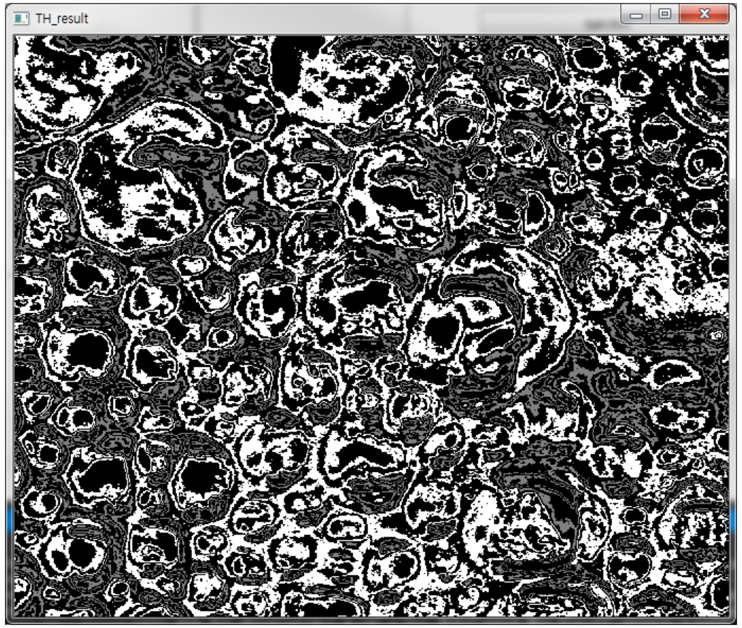
α_j의 값이 큰 경우(α_j>1/M) → 영상에서 해당 밝기 값을 갖는 영역이 주된 영역일 가능성이 높다.

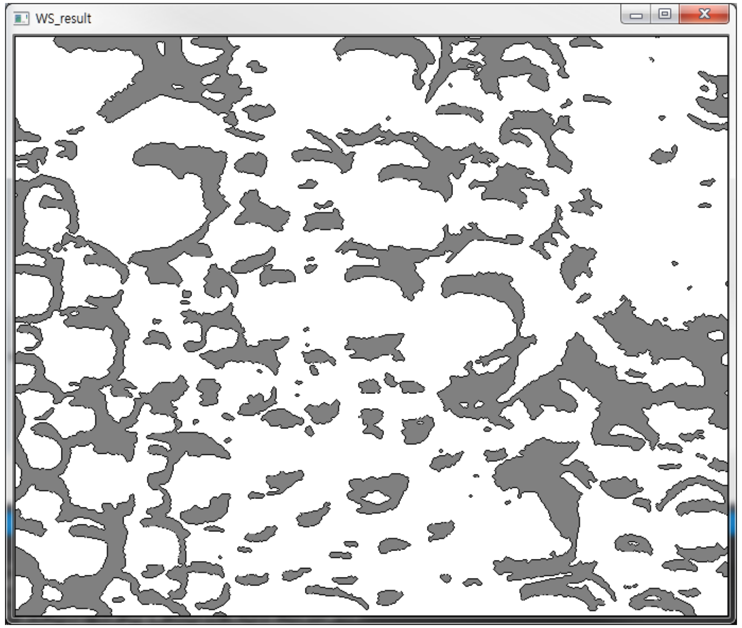


α_j>1/M



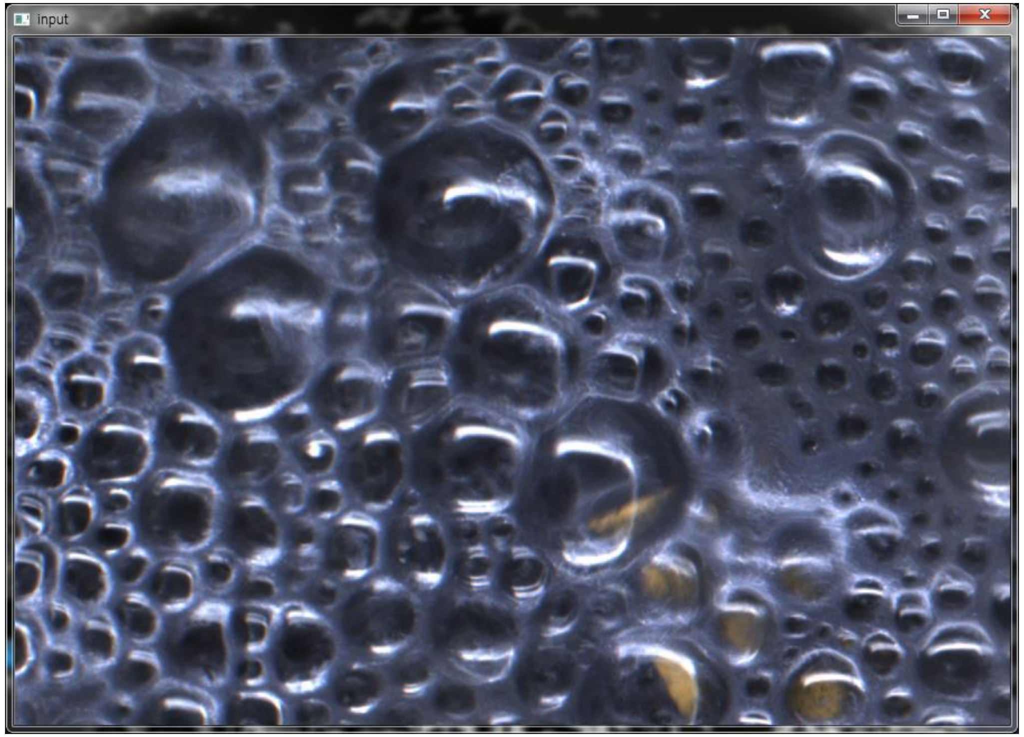
α_j<1/M

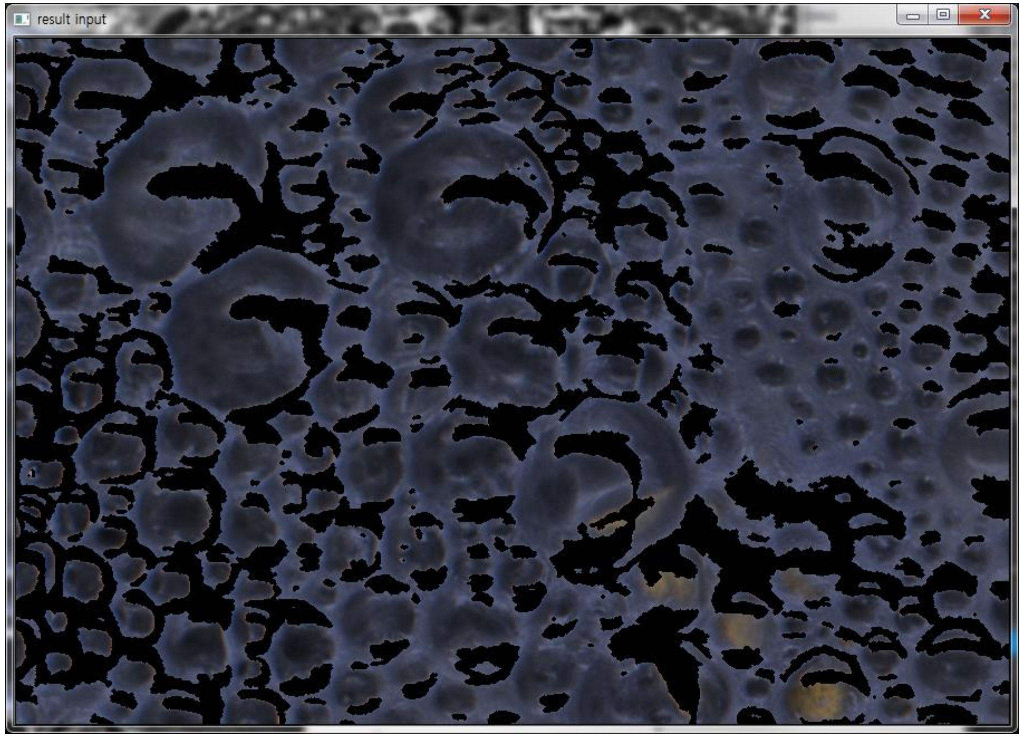


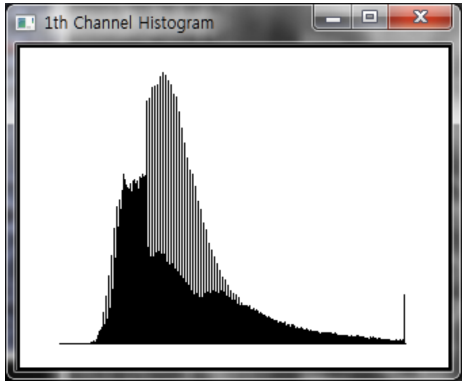


Result

-Test#1

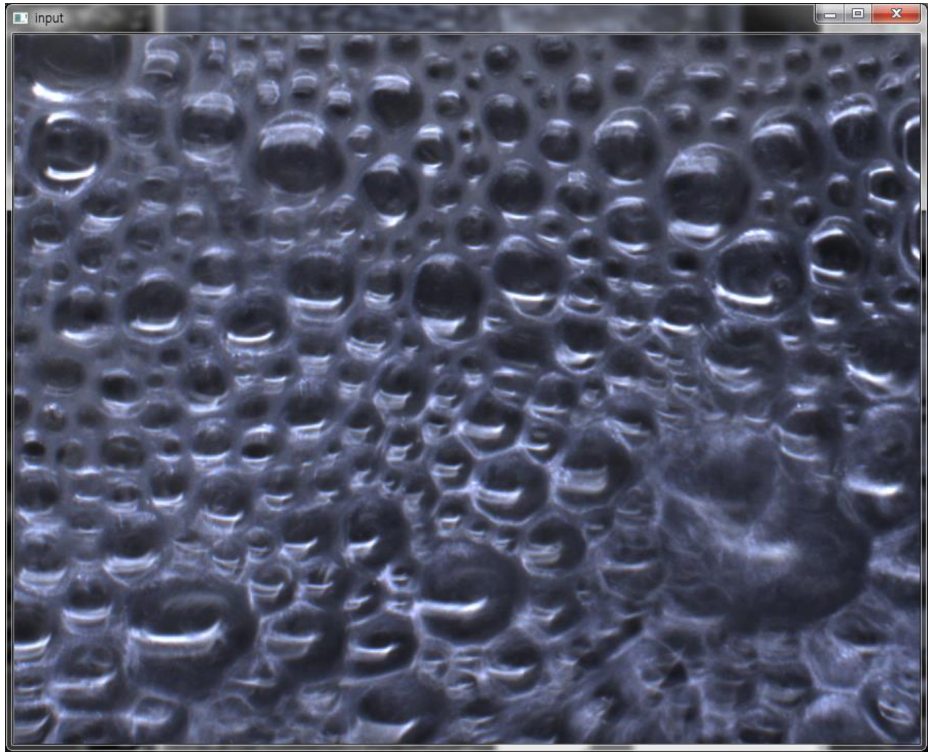


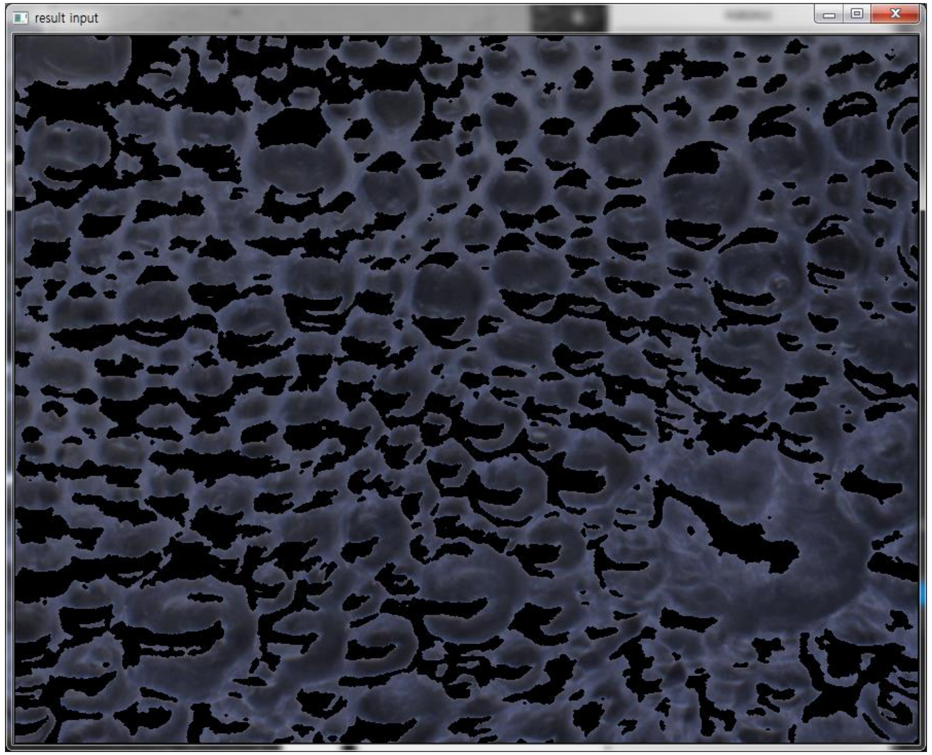


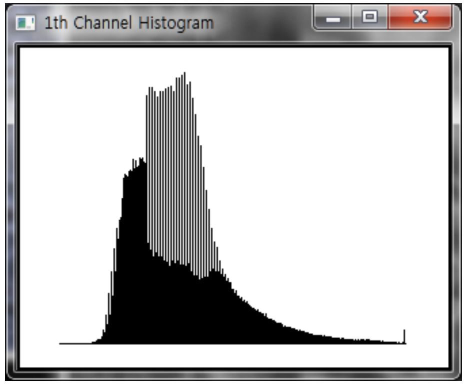


Result

-Test#2

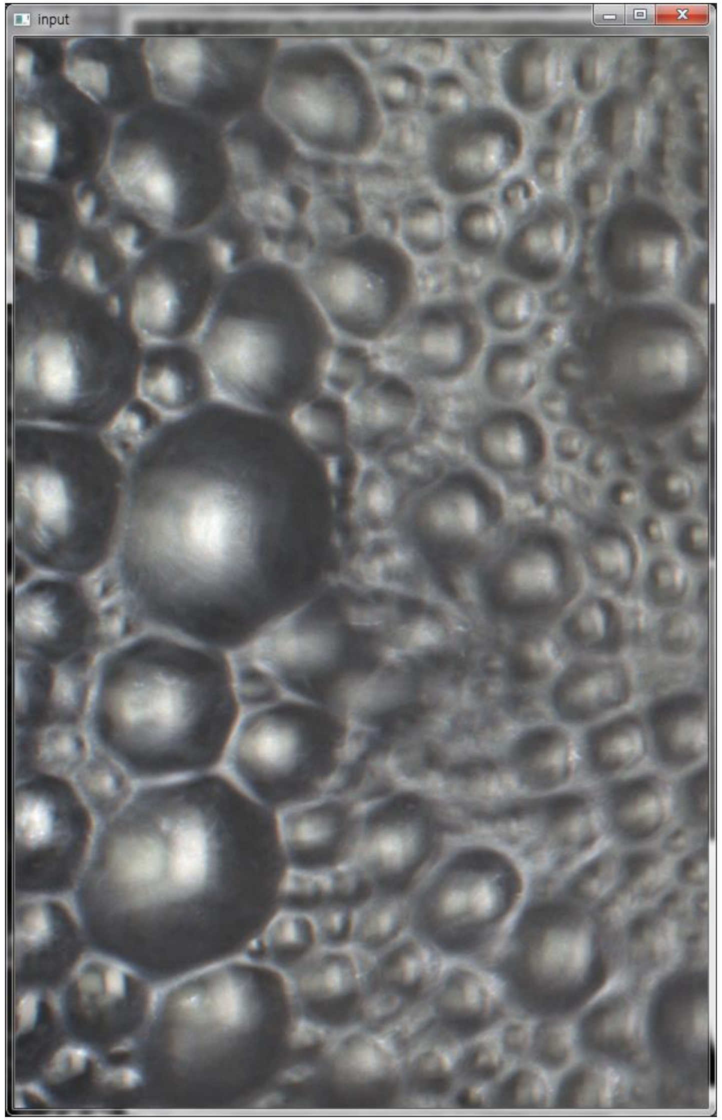


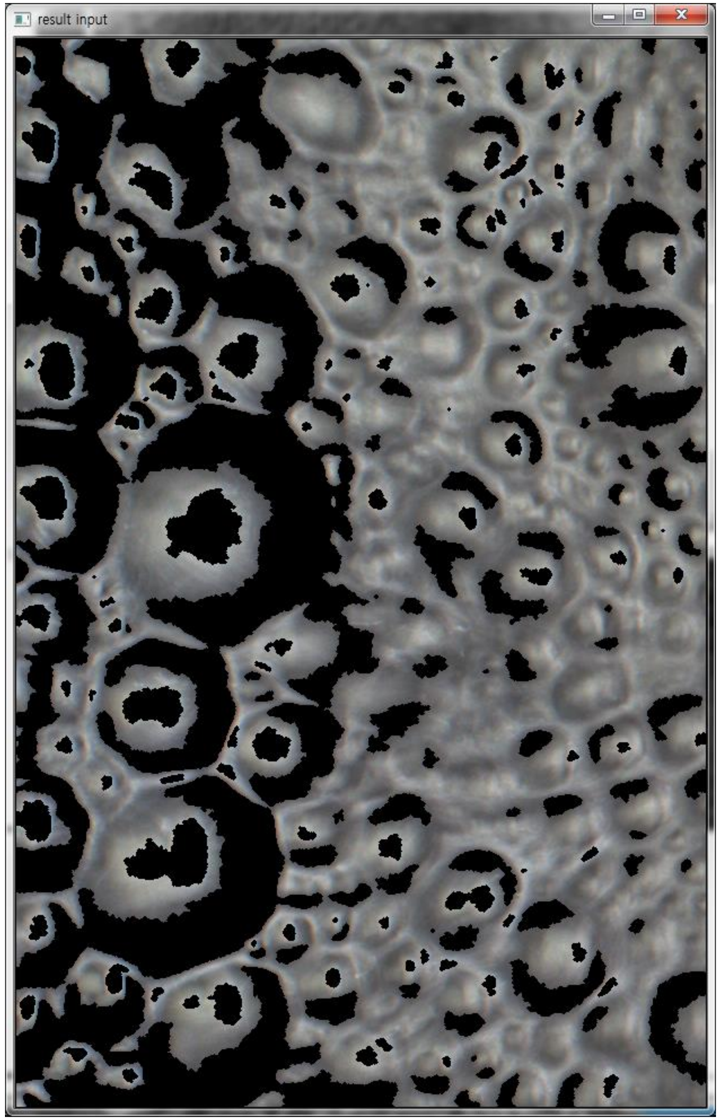


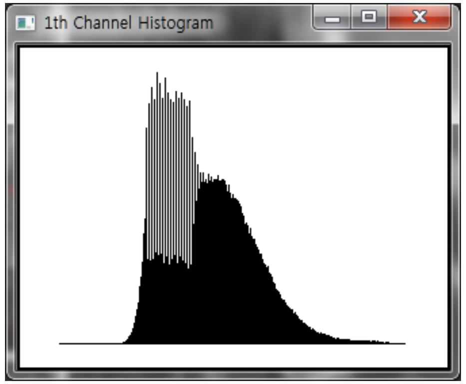


Result

-Test#3

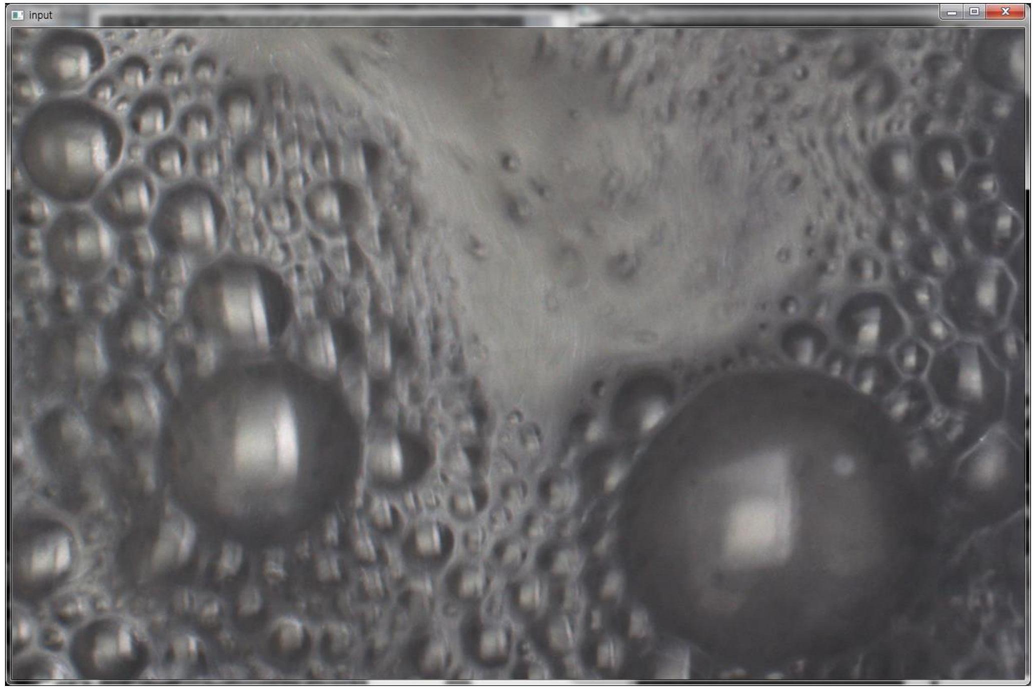


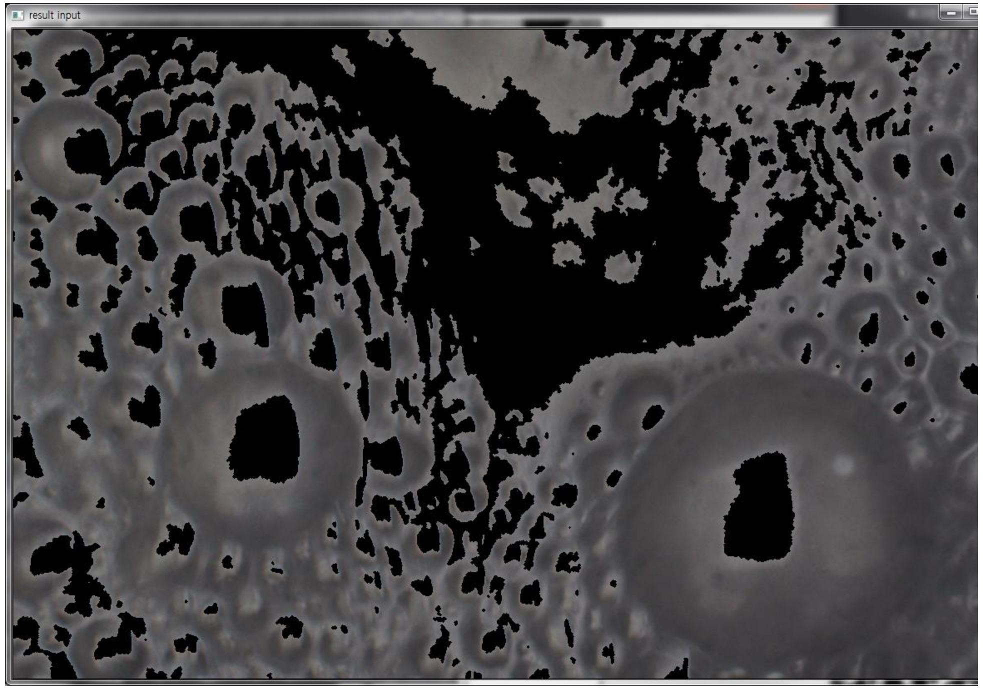


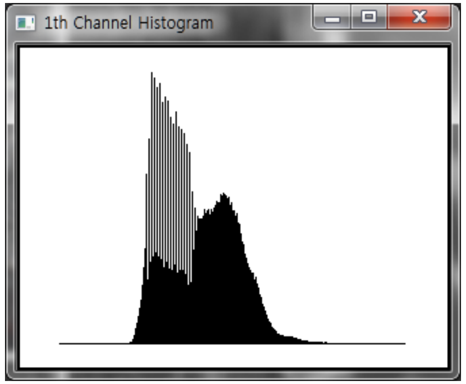


Result

-Test#4







Q & A