Lab meeting

Line Detection in Thermal Images

25.01.24
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- Drone
- Line Detection (in thermal images)
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Drone

[DJI Matrice 4T]

[Spec]

- Wide Camera
- Tele Camera
- Infrared Thermal Camera
- RTK module
- <mark>Intelligent Operations with AI</mark>

[DJI Mavic 3T]

[Spec]

- Wide Camera
- Tele Camera
- Infrared Thermal Camera
- RTK module

Drone

[DJI Matrice 4T]   <mark>**[DJI Mavic 3T]**</mark>

Due to arrival time issues...

Drone

[DJI Matrice 4T]

Resolution	DJI Matrice 4T: 640 × 512
Pixel Pitch	DJI Matrice 4T: 12 µm
Frame Rate	DJI Matrice 4T: 30 Hz
Lens	DJI Matrice 4T DFOV: 45°±0.3° DJI Matrice 4T equivalent focal length: 53 mm DJI Matrice 4T Aperture: f/1.0 DJI Matrice 4T Focus: 5 m to ∞
Sensitivity	DJI Matrice 4T: ≤50mk@F1.0
Temperature Measurement Method	DJI Matrice 4T: Spot Meter, Area Measurement
Temperature Measurement Range	DJI Matrice 4T: High Gain Mode: -20°C to 150°C (-4°F to 302°F) () Low Gain Mode: 0°C to 550°C (32°F to 1022°F)
Palette	DJI Matrice 4T: White Hot/Black Hot/Tint/Iron Red/Hot Iron/Arctic/Medical/Fulgurite/Rainbow 1/Rain
Photo Format	DJI Matrice 4T: JPEG (8bit)、R-JPEG (16bit)
Video Resolution	DJI Matrice 4T: 1280 × 1024@30fps (Super Resolution enabled, Night Mode not activated) Other conditions: 640 × 512@30fps

[DJI Mavic 3T]

Pixel Pitch	12 µm
Frame Rate	30 Hz
Lens	DFOV: 61° Format Equivalent: 40 mm Aperture: f/1.0 Focus: 5 m to ∞
Noise Equivalent Temperature Difference (NETD)	≤50 mK@F1.0
Temperature Measurement Method	Spot Meter, Area Measurement
Temperature Measurement Range	-20° to 150° C (-4° to 302° F, High Gain Mode) 0° to 500° C (32° to 932° F, Low Gain Mode)
Palette	White Hot/Black Hot/Tint/Iron Red/Hot Iron/Arctic/Medical/Fulgurite/Rainbow 1/Rain
Photo Format	JPEG (8-bit) R-JPEG (16-bit)
Video Resolution	640×512@30fps
Bitrate	6 Mbps

➔ how about using Super-Resolution?

Base Line

- Used LSD
- Used Super-Resolution for Infrared Image (PSRGAN)

  *Progressive Super-resolution Generative Adversarial Network

LSD: a Line Segment Detector

Rafael Grompone von Gioi[1], Jérémie Jakubowicz[2], Jean-Michel Morel[3], Gregory Randall[4]

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[2]TELECOM ParisTech, France (jakubowi@telecom-paristech.fr)
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Communicated by Lionel Moisan   *Demo edited by* Rafael Grompone

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Infrared Image Super-Resolution via Transfer Learning and PSRGAN

Yongsong Huang, Zetao Jiang, Rushi Lan, Shaoqin Zhang, and Kui Pi

Line Detection

- Used LSD

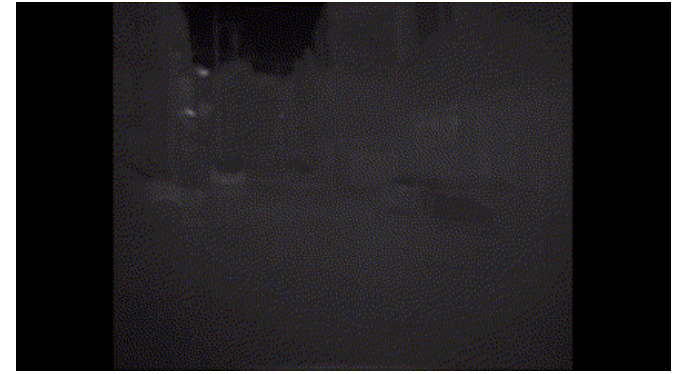Image   Level-line Field   Line Support Regions

Gradient

Level-Line
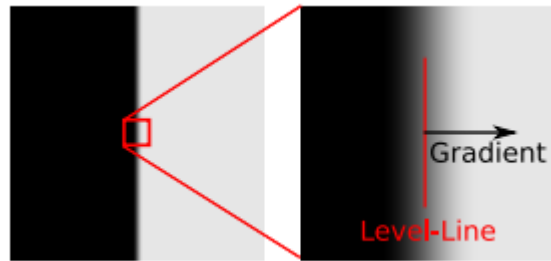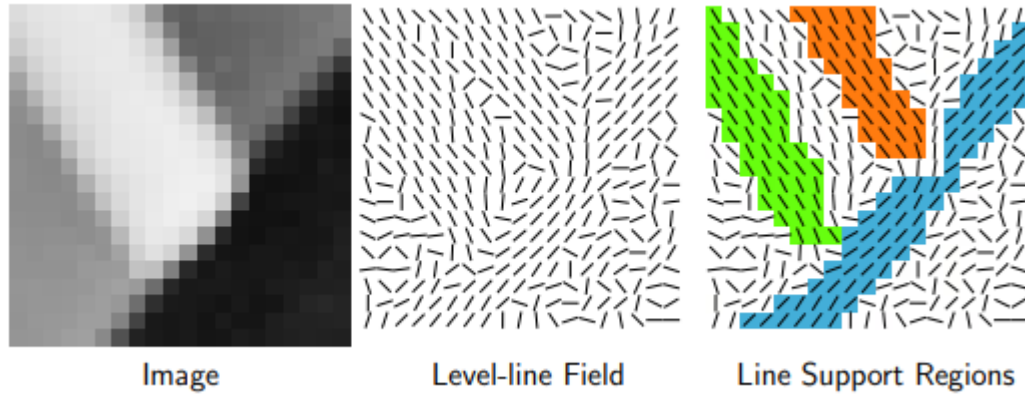
Super-Resolution

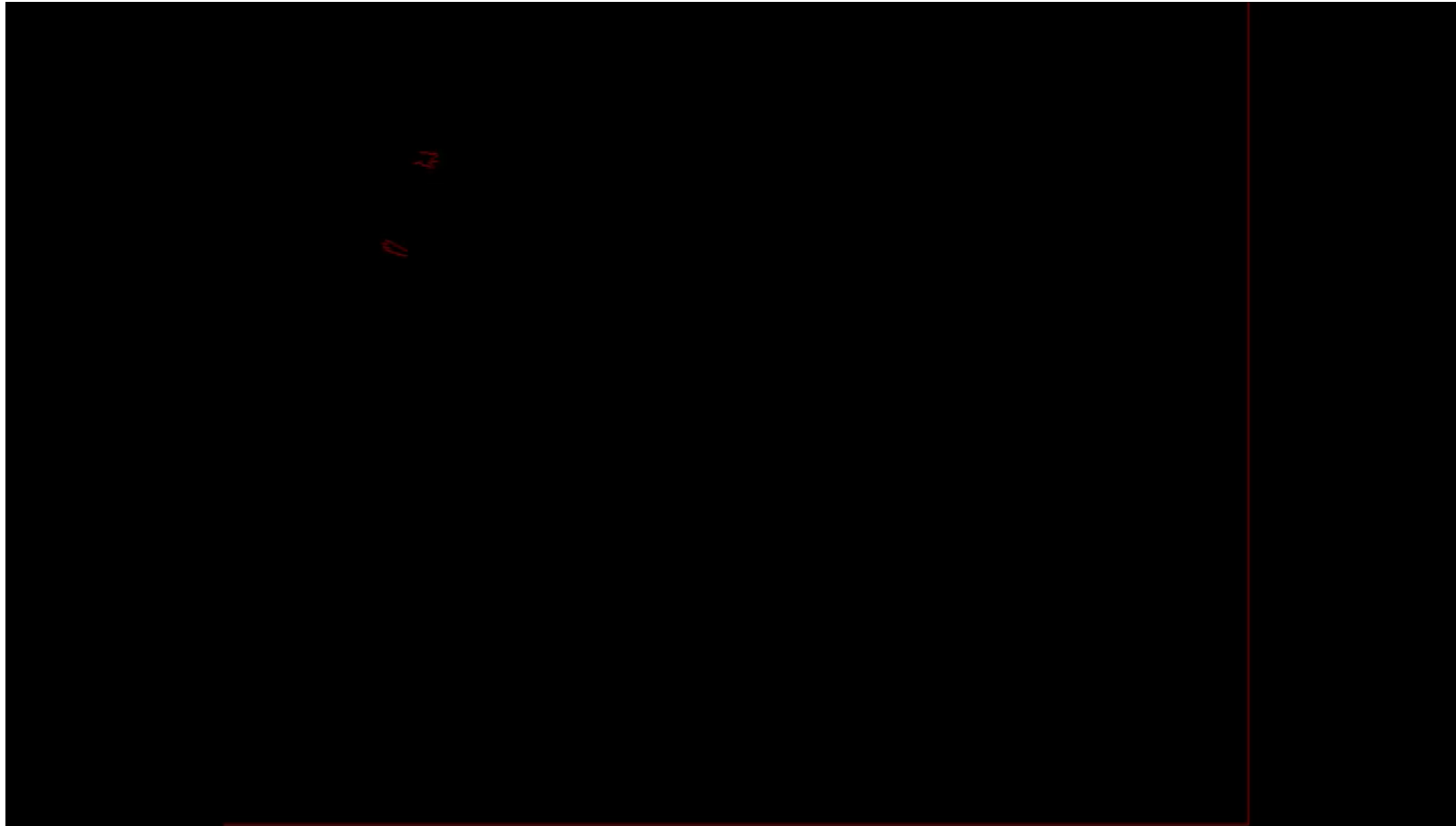- Used SR(ie.Super-Resolution) for Infrared Image
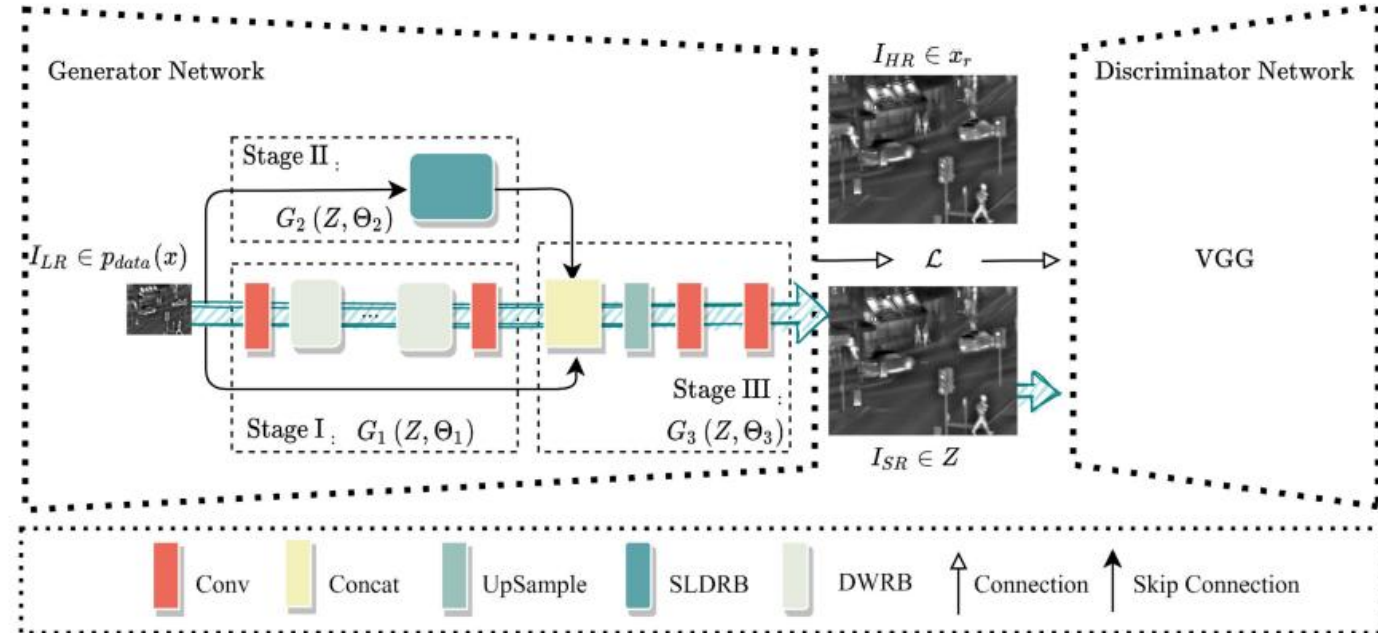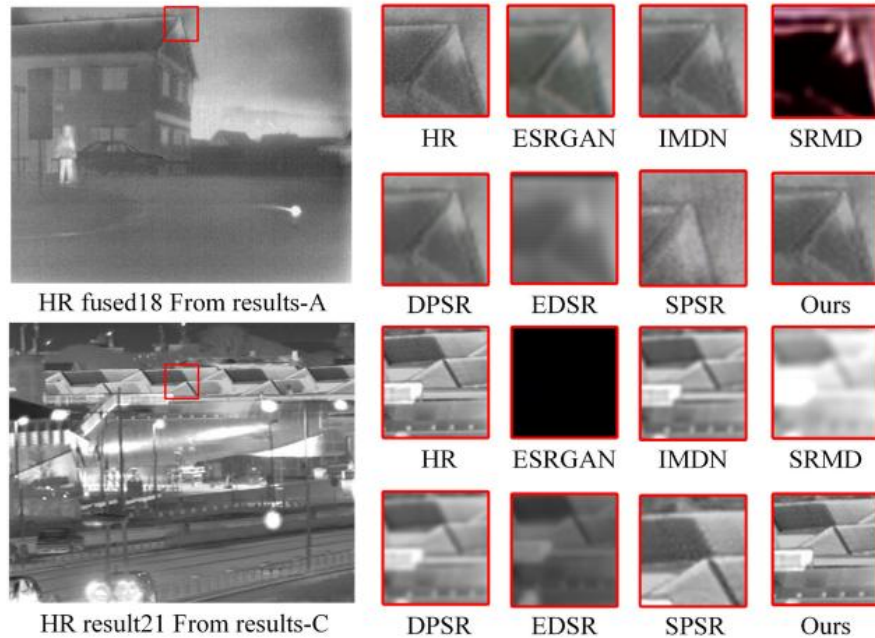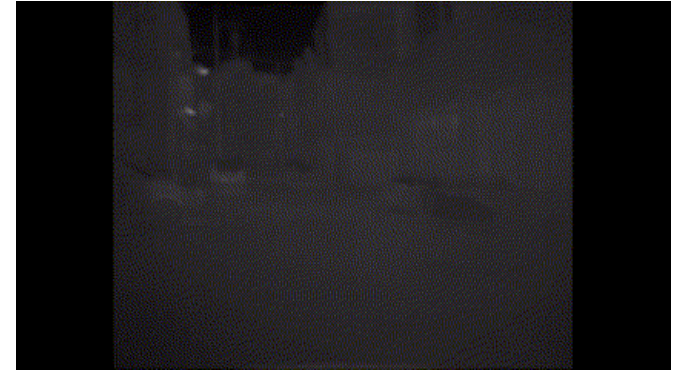
Results #1_Original

KAIST Dataset

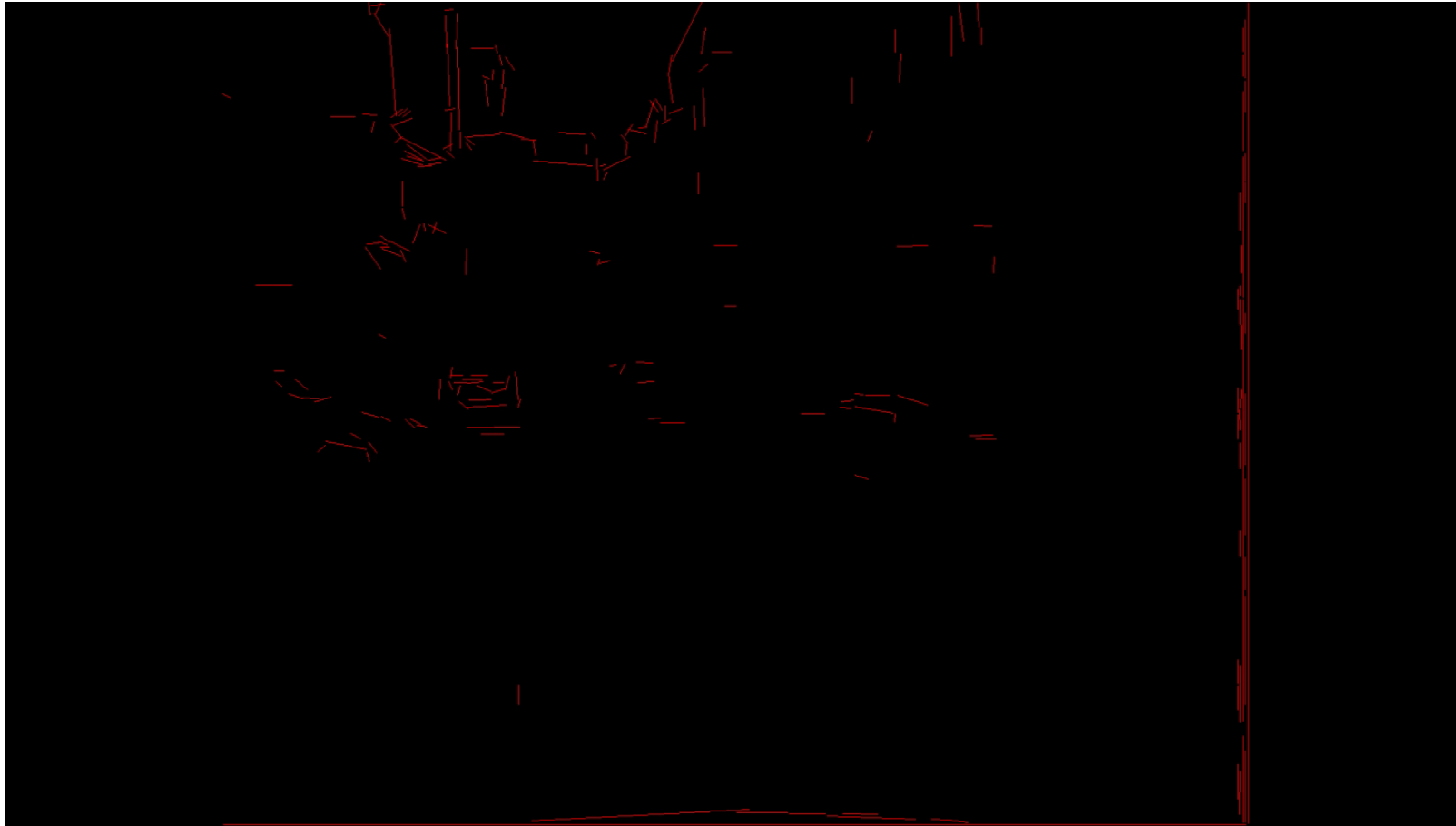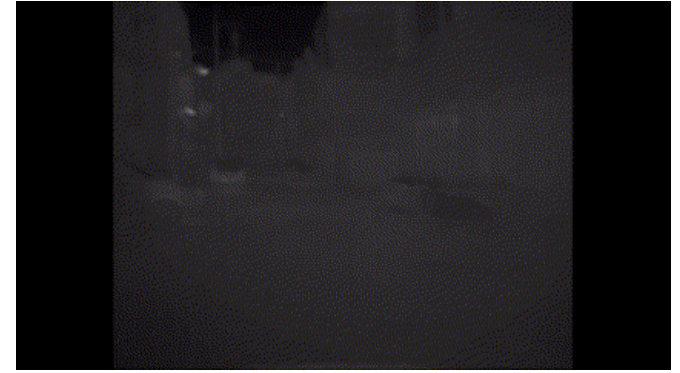# Results #1_Clahe

Results #1_SR

Results #1_Discussion

- Changed 2 parameters

  - Scale 0.8→0.6
  - Quant 2.0→0.5

```
# 파라미터 직접 지정
lsd = cv2.createLineSegmentDetector(
    refine=cv2.LSD_REFINE_NONE,  # 후처리 X
    scale=0.8,                    # 스케일링 비율
    sigma_scale=0.6,              # 가우시안 블러 정도
    quant=2.0,                    # 윤곽선 양자화 파라미터
    ang_th=22.5,                  # 각도 차 임계값
    log_eps=0,                    # 로그 eps 파라미터
    density_th=0.7,               # 밀도 임계값
    n_bins=1024                   # 히스토그램 bin 갯수
)

lsd = cv2.createLineSegmentDetector(
    refine=cv2.LSD_REFINE_NONE,  # 후처리 X
    scale=0.6,                    # 스케일링 비율
    sigma_scale=0.6,              # 가우시안 블러 정도
    quant=0.5,                    # 윤곽선 양자화 파라미터
    ang_th=22.5,                  # 각도 차 임계값
    log_eps=0,                    # 로그 eps 파라미터
    density_th=0.7,               # 밀도 임계값
    n_bins=1024                   # 히스토그램 bin 갯수
)
```
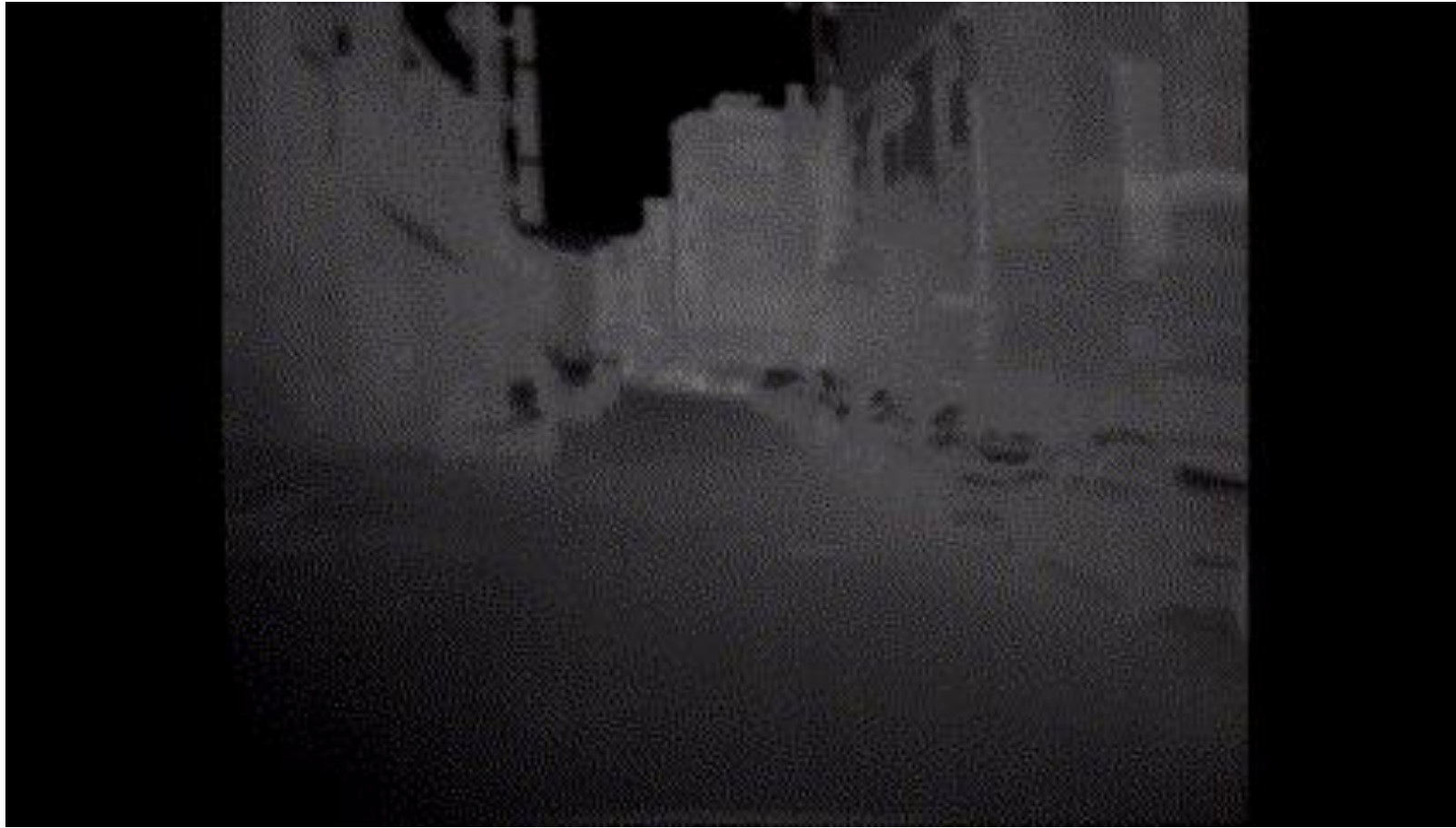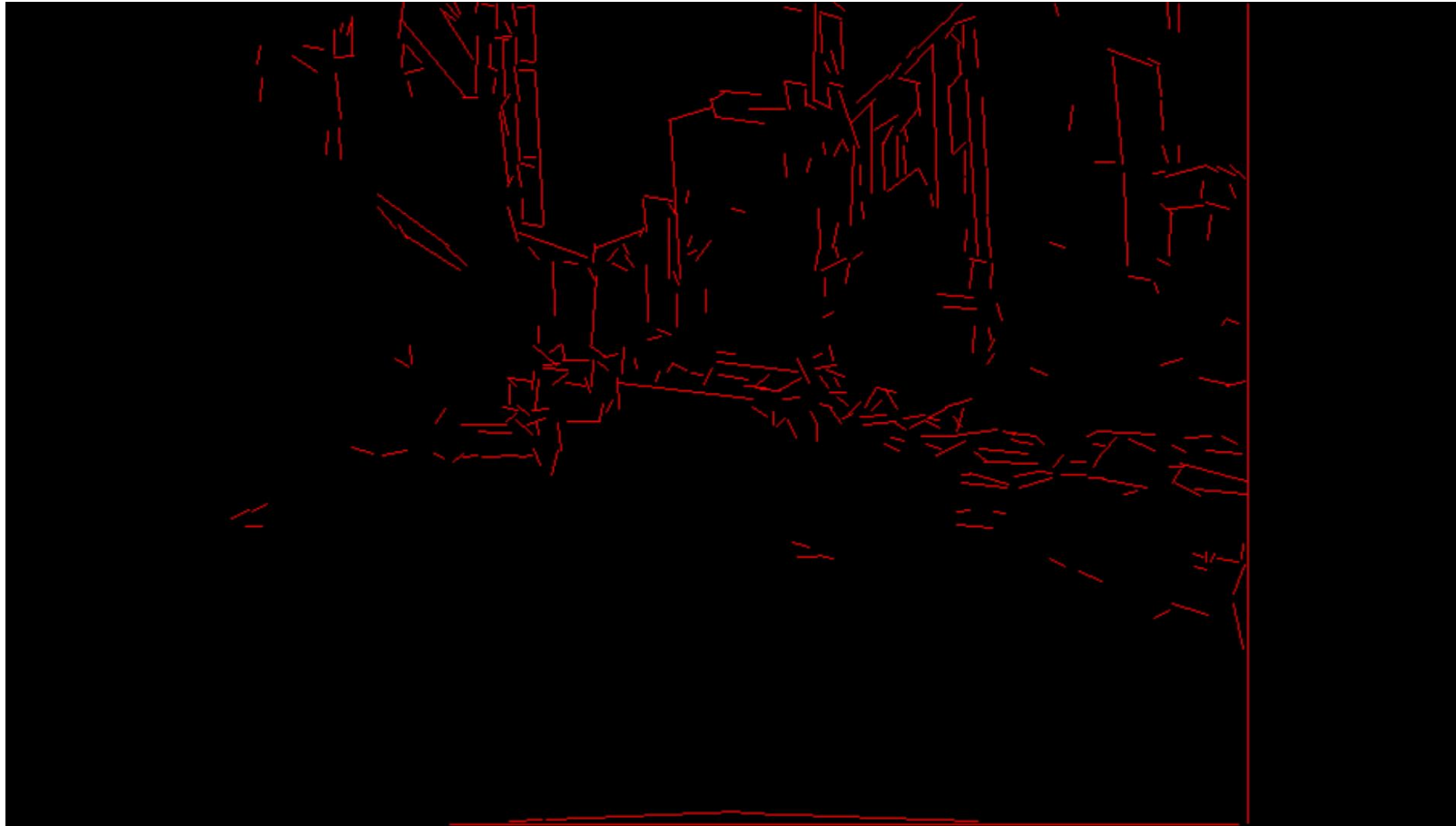
Results #1_SR(Changed)

Results #1_Clahe(Changed)
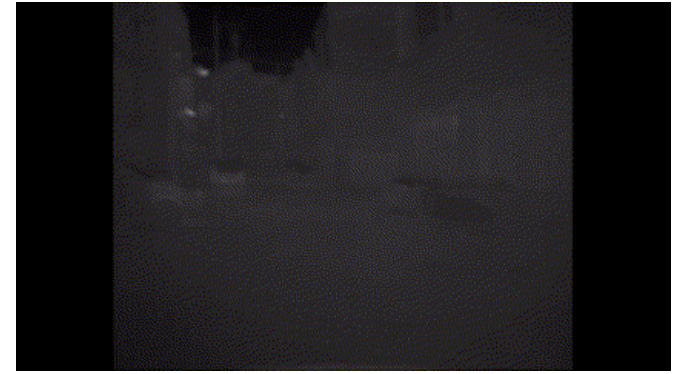
Results #2_Original

KAIST Dataset

Results #2_Clahe

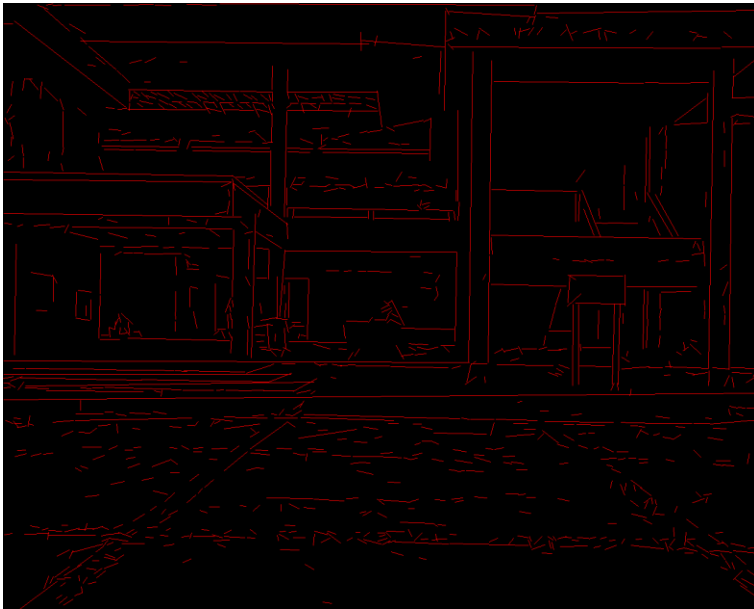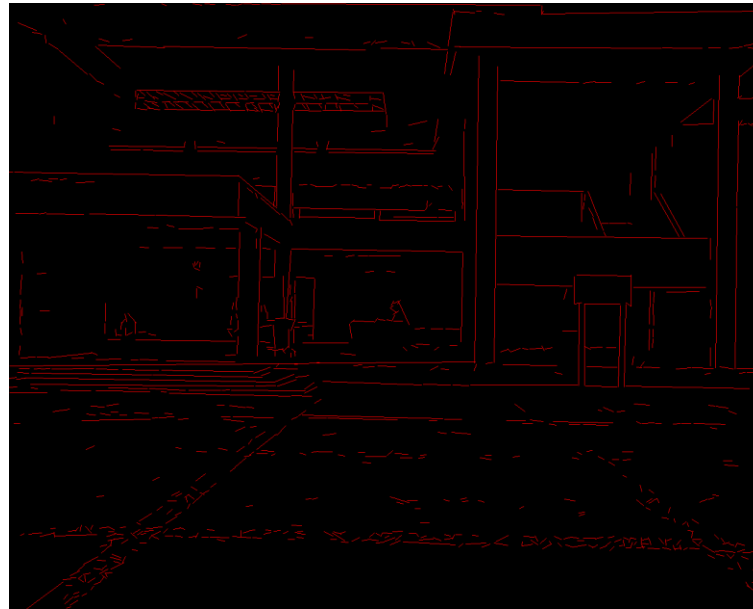# Results #2_SR (Changed)

Conclusion

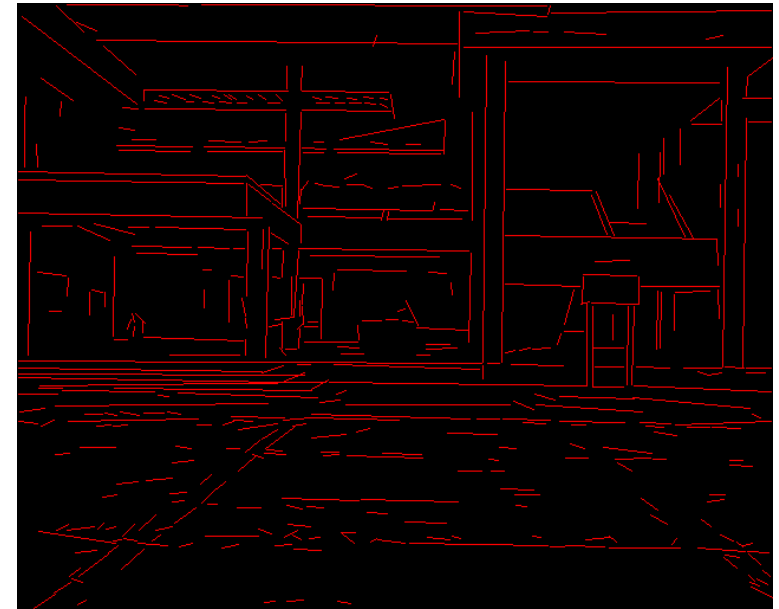- Using SR

x2

Conclusion

- Comparing 3-results

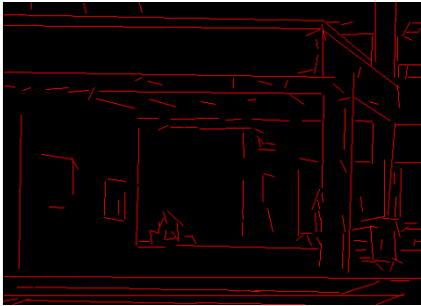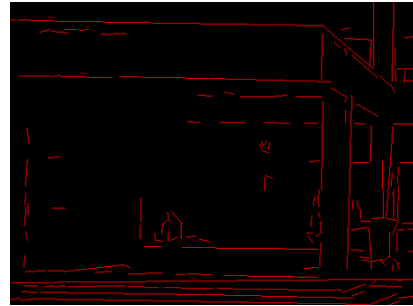[SR+LSD(changed)]   [SR+CL(ie.CLAHE)+LSD]   [CL+LSD]

Conclusion

- SR+LSD is the most!!

[SR+LSD(changed)]   [SR+CL(ie.CLAHE)+LSD]   [CL+LSD]

Future Tasks

- Construct Indoor-Dataset with Drone

- Changing a Parameter (for Improved Pre-processing Results)

- Line-Mapping using Thermal Image

Thank You
for Listening