Cam_Not_working_Solutions

Issue: Camera Captures Black Images (Jetson Nano / USB Camera)

This document lists common reasons why a USB camera captures black images and the corresponding solutions.

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1. Camera Not Warmed Up (Most Common Issue)

Reason: - Initial frames from the camera may be empty or dark.

Solution:

```python
time.sleep(2)
# Discard initial frames
for _ in range(5):
    cam.read()
```

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2. Incorrect Camera Index

Reason: - The default camera index `0` may not correspond to the connected camera.

Solution:

```
ls /dev/video*
```

Try different indices:

```python
cv2.VideoCapture(1)
```

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3. Auto Exposure Not Stabilized

Reason: - Auto-exposure starts at a low value, causing black frames.

Solution:

```
cam.set(cv2.CAP_PROP_AUTO_EXPOSURE, 0.75)
time.sleep(2)
```

4. Resolution or Format Mismatch

Reason: - Camera default resolution or format may not be compatible with OpenCV.

Solution:

```
cam.set(cv2.CAP_PROP_FRAME_WIDTH, 640)
cam.set(cv2.CAP_PROP_FRAME_HEIGHT, 480)
```

5. Camera Already in Use

Reason: - Another application is accessing the camera device.

Solution:

```
fuser /dev/video0
sudo kill -9 PID
```

6. Permission Issues

Reason: - User does not have access to video device.

Solution:

```
sudo usermod -aG video $USER
# Logout and login required
```

7. USB Power or Bandwidth Issues

Reason: - Insufficient power or USB hub limitations.

Solution: - Connect camera directly to Jetson Nano USB port - Avoid USB hubs

8. Verify Camera Outside OpenCV

Reason: - To confirm whether issue is hardware or code related.

Solution:

```
sudo apt install v4l-utils -y
v4l2-ctl --list-devices
v4l2-ctl --stream-mmap --stream-count=10 --stream-to=test.raw
```

Minimal Robust Capture Logic (Reference)

```python
cam = cv2.VideoCapture(0)
time.sleep(2)

for _ in range(5):
    cam.read()

ret, frame = cam.read()
if not ret or frame is None:
    print("Capture failed")
else:
    cv2.imwrite(IMAGE_PATH, frame)

cam.release()
```

Viva-Ready Explanation

Black images occur due to camera warm-up, incorrect camera index, exposure stabilization issues, or permission problems. Discarding initial frames and verifying camera access resolves the issue.