

isp_graph_template.yaml

version: 0.1

graph:

name: ai_isp_pc_simulator

description: >

Graph-based ISP simulator supporting computational photography:

HDR, multi-frame, multi-cam fusion, EIS, VSR, RAW-AI ISP, IQA, and policy engine.

types:

Frame:

channels: [BAYER, RGB, YUV]

fields:

- name: tensor
dtype: float32
shape: [H, W, C]
- name: timestamp_us
dtype: int64
- name: exposure_time_us
dtype: int32
- name: iso
dtype: int32
- name: camera_id
dtype: string
- name: pose
dtype: float32[4,4]
- name: intrinsics
dtype: float32[3,3]
- name: ois_gyro
dtype: float32[6]
- name: metadata
dtype: map<string, any>

Flow:

fields:

- name: frames
dtype: list<Frame>
- name: alignment
dtype: map<string, any>

nodes:

- id: raw_input
kind: source
out: Frame[BAYER]
params: {pattern: "RGGB", bit_depth: 12, simulate_noise: true, simulate_motion: true}
- id: dpc
kind: op
in: Frame[BAYER]

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  out: Frame[BAYER]
  params: {method: "classic"} # classic | ai
- id: blc
  kind: op
  in: Frame[BAYER]
  out: Frame[BAYER]
  params: {offset: "auto"}
- id: lsc
  kind: op
  in: Frame[BAYER]
  out: Frame[BAYER]
  params: {calib_pack: "auto"}
- id: raw_ai_dn_dm
  kind: op
  in: Frame[BAYER]
  out: Frame[BAYER]
  params: {model: "unet_v1", iso_cond: true, tiled: true}
- id: burst_buffer
  kind: buffer
  in: Frame[BAYER]
  out: Flow
  params: {window: 5, mode: "burst|bracket"}
- id: align_dl
  kind: op
  in: Flow
  out: Flow
  params: {model: "align_net_v1", motion_mask: true}
- id: hdr_fusion
  kind: op
  in: Flow
  out: Frame[BAYER]
  params: {method: "content_adaptive", highlight_protect: true}
- id: tone_mapping
  kind: op
  in: Frame[BAYER]
  out: Frame[RGB]
  params: {global_local: "hybrid", skin_sky_prior: true}
- id: demosaic
  kind: op
  in: Frame[BAYER]
  out: Frame[RGB]
  params: {method: "ai|classic"}
- id: awb
  kind: op
```

in: Frame[RGB]
out: Frame[RGB]
params: {mode: "hybrid"}

- id: ee
kind: op
in: Frame[RGB]
out: Frame[RGB]
params: {strength: 0.4}
- id: multicam_mux
kind: source
out: Flow
params: {cams: ["wide", "tele", "ultrawide"], sync: "hw+sw"}
- id: multicam_calib
kind: op
in: Flow
out: Flow
params: {geom_color_calib: "auto"}
- id: seamless_zoom
kind: op
in: Flow
out: Frame[RGB]
params: {content_aware_blend: true}
- id: eis_motion
kind: op
in: Flow
out: Flow
params: {model: "eis_v1", rs_aware: true}
- id: warp_resample
kind: op
in: Flow
out: Frame[RGB]
params: {latency_ms_budget: 8}
- id: vsr
kind: op
in: Flow
out: Frame[RGB]
params: {model: "vsr_tiny", temporal_consistency: true}
- id: iqa_offline
kind: sink
in: Frame[RGB]
params: {metrics: ["PSNR", "SSIM", "LPIPS", "NIQE", "NIMA"]}
- id: scene_semantics
kind: op
in: Frame[RGB]

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out: Frame[RGB]
params: {classes: ["sky","skin","text","lowlight","backlit"]}
- id: policy_engine
kind: controller
in: Frame[RGB]
out: map<string, any>
params:
  strategies:
    tm_curve: ["natural","vivid","flat"]
    hdr_strength: [0.2, 0.5, 0.8]
    eis_strength: [0,1,2]
    zoom_mode: ["blend","switch"]
pipelines:
photo_single_cam:
edges:
- [raw_input, dpc]
- [dpc, blc]
- [blc, lsc]
- [lsc, raw_ai_dn_dm]
- [raw_ai_dn_dm, burst_buffer]
- [burst_buffer, align_dl]
- [align_dl, hdr_fusion]
- [hdr_fusion, tone_mapping]
- [tone_mapping, awb]
- [awb, ee]
- [ee, iqa_offline]
photo_multicam_zoom:
edges:
- [multicam_mux, multicam_calib]
- [multicam_calib, seamless_zoom]
- [seamless_zoom, iqa_offline]
video_hdr_eis_vsr:
edges:
- [raw_input, raw_ai_dn_dm]
- [raw_ai_dn_dm, burst_buffer]
- [burst_buffer, align_dl]
- [align_dl, tone_mapping]
- [tone_mapping, scene_semantics]
- [scene_semantics, policy_engine]
- [raw_input, burst_buffer]
- [burst_buffer, eis_motion]
- [eis_motion, warp_resample]
- [warp_resample, vsr]
- [vsr, iqa_offline]

```

