Evaluating Video Transmission Quality using AlphaRTC

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Overview

- Use AlphaRTC for real-time video transmission.
- Evaluate video quality using VMAF.
- Estimate network throughput.
- Present results through visualization.

AlphaRTC and VMAF

AlphaRTC:

- Open platform for real-time communication.
- Uses reinforcement learning for congestion control.

VMAF:

- Open-source perceptual video quality metric.
- Developed by Netflix.

Video Preprocessing (1)

Step 1: Resize video

```
ffmpeg -i usain_bolt.mp4 -vf "scale=320:240,setdar=4/3" usain_bolt_0.mp4
```

Step 2: Crop 11s–26s

```
ffmpeg -ss 00:00:11 -to 00:00:26 -i usain_bolt_0.mp4 usain_bolt_1.mp4
```

Video Preprocessing (2)

Step 3: Reduce FPS to 10

```
ffmpeg -i usain_bolt_1.mp4 -filter:v fps=10 usain_bolt_10.mp4
```

Step 4: Extract YUV and WAV

```
ffmpeg -i usain_bolt_10.mp4 usain_bolt.yuv
ffmpeg -i usain_bolt_10.mp4 usain_bolt.wav
```

Modifying AlphaRTC Code

Customize BandwidthEstimator.py

```
class Estimator(object):
    def report_states(self, stats: dict):
        with open("stats.txt", "a") as f:
            f.write(str(stats) + "\n")

    def get_estimated_bandwidth(self)->int:
        return int(1e6) # 1Mbps
```

Transmission Command

```
sudo docker run -d --rm \
  -v <path>/corpus:/app \
  -w /app --name alphartc \
  --platform linux/amd64 alphartc \
  peerconnection_serverless receiver_pyinfer.json

sudo docker exec alphartc \
  peerconnection_serverless sender_pyinfer.json
```

Quality Evaluation with VMAF

```
vmaf --reference usain_bolt.yuv \
  --distorted out_usain_bolt.yuv \
  --width 320 --height 240 \
  --pixel_format 420 --bitdepth 8 \
  --model version=vmaf_v0.6.1 \
  --output output.xml --frame_cnt 30
```

- Compares first 30 frames after frame 24 for best score.

Throughput Estimation Code

```
total_time_ms = 0
total_payload_size = 0
stats = [eval(x) for x in open("stats.txt")]

for data in stats:
    if 'arrival_time_ms' in data:
        delta = data["arrival_time_ms"] - last_arrival_time
        total_time_ms += delta
        last_arrival_time = data["arrival_time_ms"]
        total_payload_size += int(data["payload_size"])

print(total_payload_size * 1000 / total_time_ms)
```

Results Summary

- **VMAF Score:** 8.27
- **Throughput:** 21.89 KB/ms
- VMAF plot saved and analyzed.

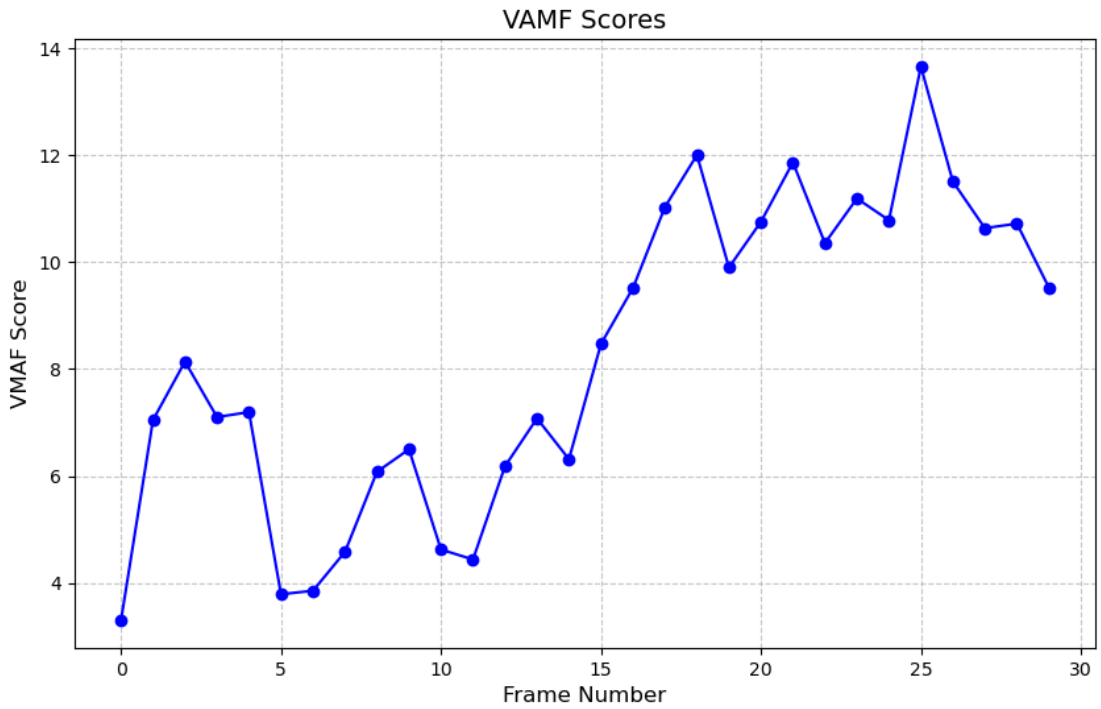

Figure: VMAF Score per Frame

Conclusion

- AlphaRTC + VMAF = efficient evaluation of video quality.
- Preprocessing and frame selection are key.
- Throughput and VMAF provide clear performance metrics.

Thank You!