cencro – Speedup of Video Quality Calculation using Center Cropping

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code cencro: `https://git.io/JeR5q`

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Motivation

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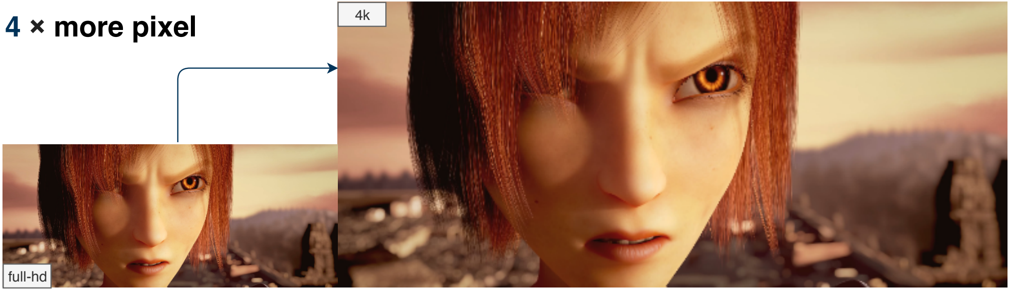

- increase of video resolution (full-HD, 4K/UHD-1, 8K/UHD-2, ...)
- more processing time for video quality estimation required
- e.g. full-reference methods (VMAF); 45 mins for 4K 10 s sequence

$\rightarrow$ review of video quality models

Video Quality Estimation

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- categorized in no-ref, red-ref, **full-ref** models [13]
  - PSNR, MS-SSIM [16, 15], VIF [14]: fast but not accurate
  - Netflix's VMAF [10, 7]: accurate, slow
  - DNN based models: [2, 4, 3, 5, 6]: accurate and slower
  - brisque+niqe [8, 9]: fast but not always accurate, ...
- subjective tests: cross-lab evaluation *Pinson and Wolf* [11]: Pearson correlations: 0.902 to 0.935 ($\approx 4\%$ error) for MOS,

$\rightarrow$ general principle to speedup full-ref calculations

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Our Approach– *cencro*

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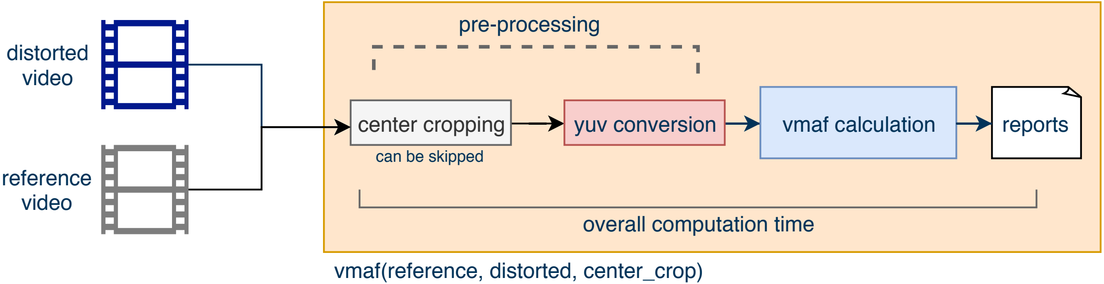

- focus: per frame reduction: center cropping of frames → **cencro**
- metric: VMAF; processing time: $t_{all} = t_{dis} + t_{ref} + t_{VMAF}$
- questions: what are suitable center crops? calculation speedup? acceptable error?

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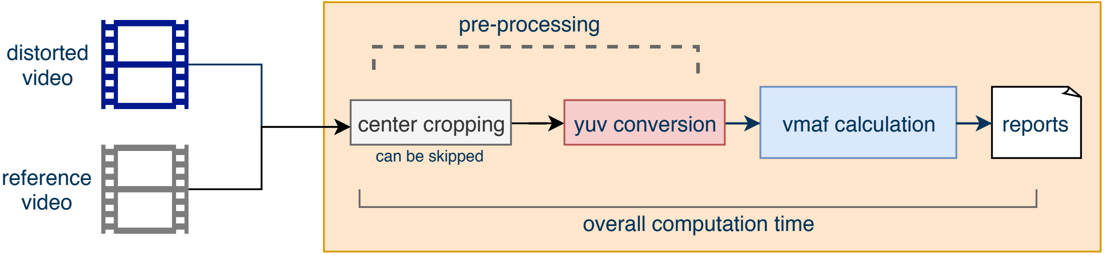

vmaf(reference, distorted, center_crop)

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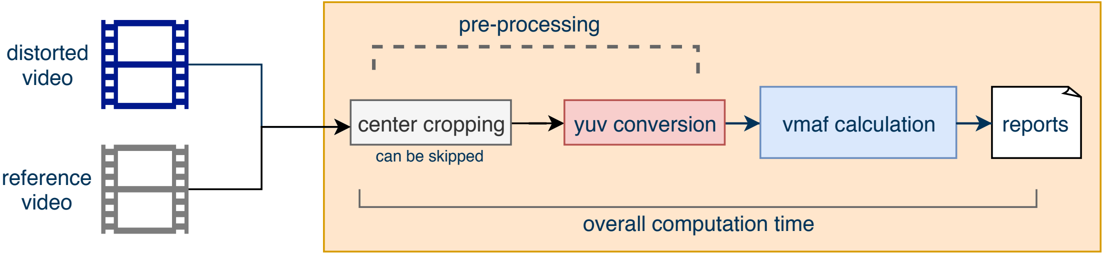

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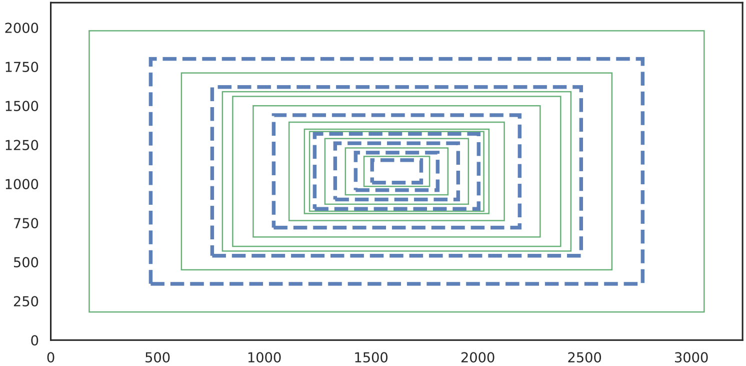

- total **18** center crop settings:
  144, 192, **240**, 300, **360**, 420, **480**, 510, 540, 630, **720**, 840, 960, 1020, **1080**, 1260, **1440**, 1800
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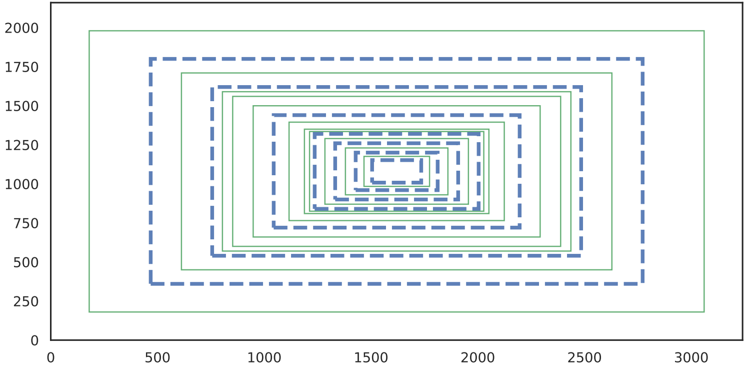

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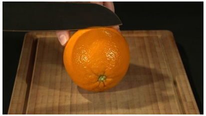
Evaluation – Datasets






codecs	h264, h265, vp9			
resolutions	360p	720p	1080p	2160p
bitrates in Mbit/s	[0.2,0.75]	[1,2]	[2,7.5,15]	[7.5,15,40]

- 4K videos: subset of AVT-VQDB-UHD-1 [12]; **150 encoded videos**
- + GamingVideoSET [1]; 24 full-HD videos, **90 encoded videos**

Evaluation – Center Cropping – VMAF

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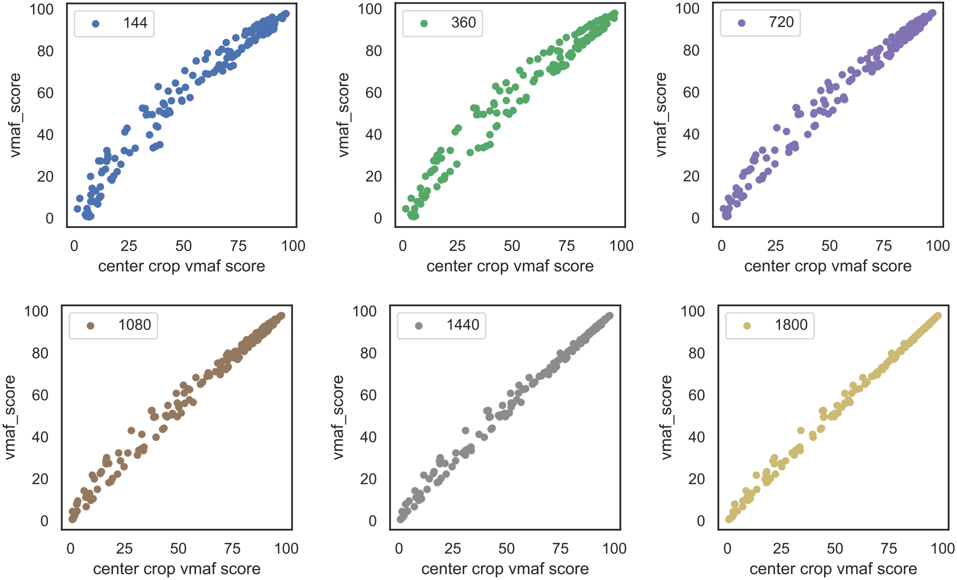
- comparison VMAF score with center cropped VMAF score



Evaluation – Center Cropping – VMAF Error

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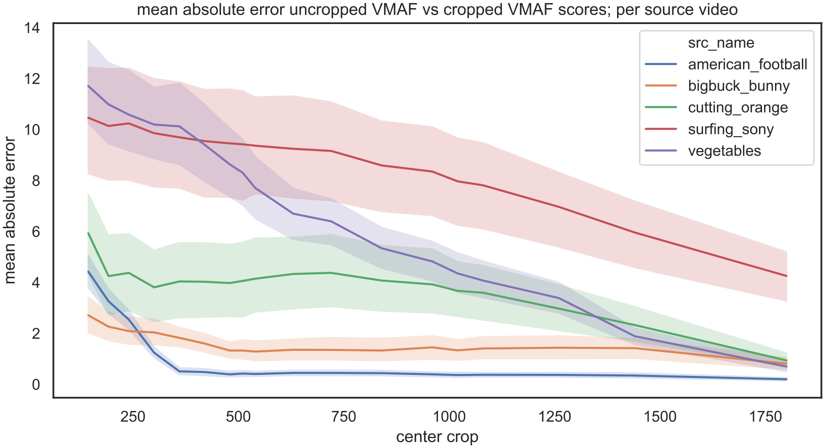
- mean absolute error per source video; VMAF $\in [0, 100]$



Evaluation – Cencro – Correlations and Error

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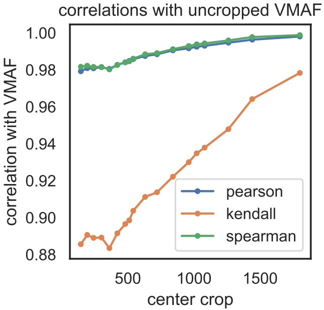

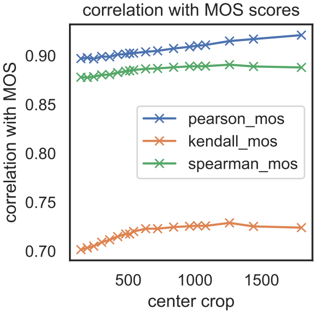

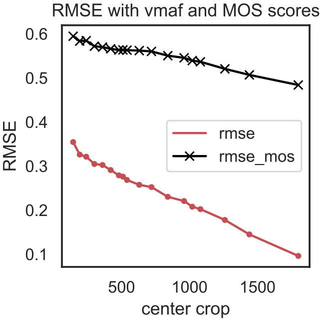

- higher crop → lower RMSE, higher correlation
- error still acceptable (e.g. for 360p cc)

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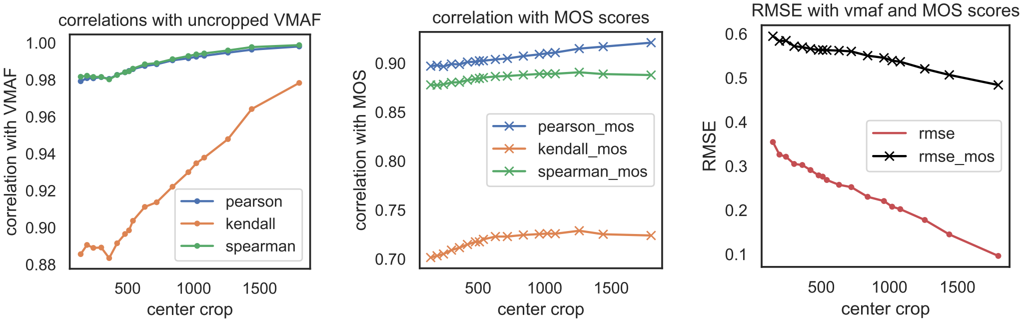

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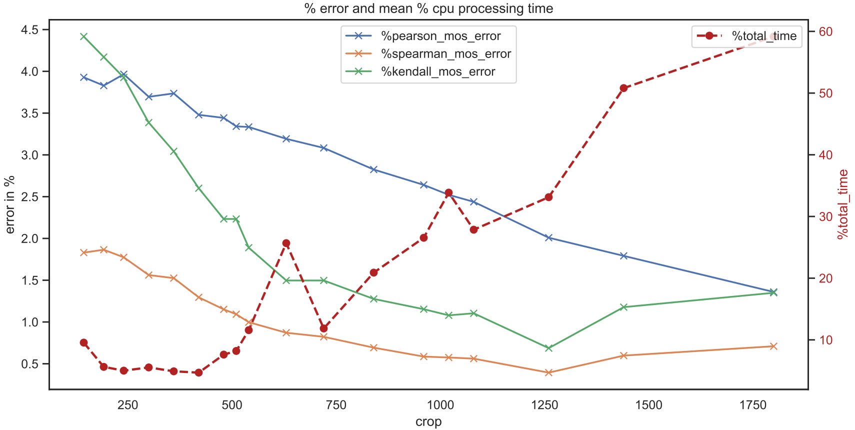
Evaluation – Center Cropping – Error vs Time

- % error (MOS prediction) vs % t_{all}; 100%time ≈ 45 min



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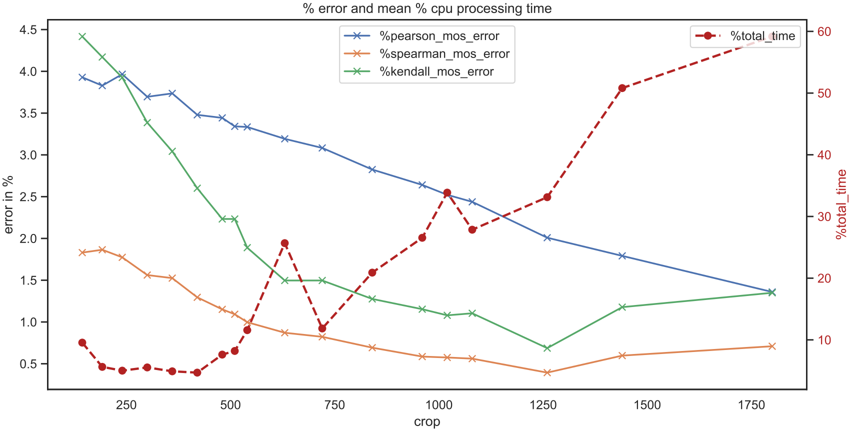

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  - speedup video quality calculation using center cropping of video frames
  - analysis of possible center crop settings
- error and speedup
  - 360p shows low error in case of 4K, comparable with cross-lab repeatition
  - 360p time saving up to 95%
  - 1080p can save up to 65% time with error of 2.5%
- open and next steps:
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Thank you for your attention

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. . . . . . are there any questions?

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