m17612:

Estimation of temporally consistent depth maps using noise removal from video

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A new tool for providing temporally consistent depth maps

Temporal inconsistency results from noise

Attack on noise suppresses temporal inconsistency
Idea of the proposal

- Remove noise from input sequences independently
- Then estimate depth with any state-of-the-art technique

Proposed noise reduction tool

Input multi-view video sequence

Proposed noise reduction tool

Depth estimation (DERS)

Output depth data
Noise reduction technique

- Some artifacts are allowed – results are not shown to the audience anyway
- Simple temporal noise reduction based on filtering
- Focus on steady fragments of the scene
  - Background
  - Stopping objects
Scheme of the algorithm

Input video sequence

Input frame

Motion detector

Steady or moving?

Filter

Original frames

Denoised frames

Binary motion maps

Motion Detection buffer
Motion detector

- Classifies pixels from input frame as **moving** or as **steady**
- Outputs with **binary motion map**
- Consists of simple filtering
  - morphological
  - non-linear
  - 9x9 mask
Motion map
Filtering

- Performs actual noise reduction
  - Short IIR (Infinite Impulse Response) filter
  - Almost linear phase
  - Computationally efficient
- Applied only on **steady** pixels
- **Moving** pixels are left unchanged
Experimental results

Subjective quality (MOS)

- Depth maps obtained from original sequence
- Depth maps obtained from denoised sequence

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Original PSNR</th>
<th>Denoised PSNR</th>
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<tbody>
<tr>
<td>Poznan_Street</td>
<td>35.53dB</td>
<td>35.39dB</td>
</tr>
<tr>
<td>Poznan_Carpark</td>
<td>31.22dB</td>
<td>31.21dB</td>
</tr>
<tr>
<td>Book arrival</td>
<td>36.21dB</td>
<td>36.23dB</td>
</tr>
<tr>
<td>Alt Moabit</td>
<td>35.49dB</td>
<td>35.51dB</td>
</tr>
</tbody>
</table>
Conclusions

- A new tool aimed at providing temporally consistent depth maps.
- An alternative for Temporal Consistency in DERS (not exclusive!)
- The subjective gains are considerable, and range from about 0.7 to 1.2 in MOS (1-10) scale.
Recommendation

- To incorporate this new tool into DERS as an additional Temporal Consistency mode.
Thanks for your attention!

- Questions?