

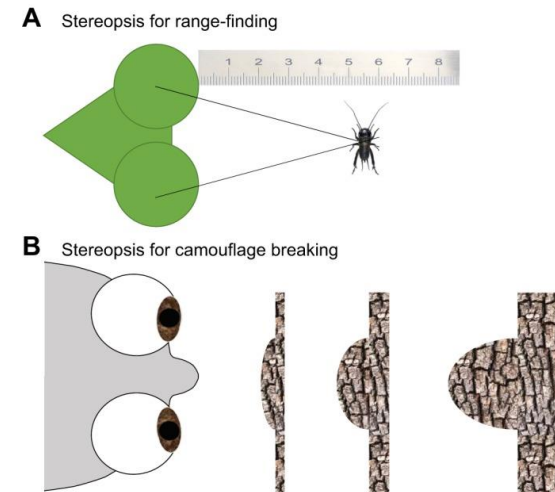
The 10th Visual Object Tracking Challenge Results VOT-RGBD2022 and VOT-D2022

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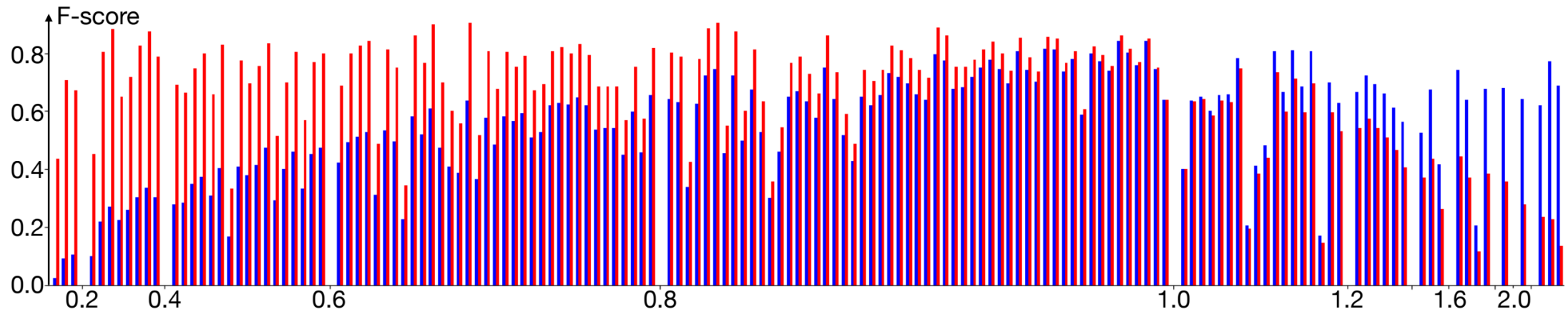
Why to add depth?

- *Depth perception* is a **vision-enabled skill** for many animals
- Evolutionary hypotheses¹: 1) **Range finding**, 2) **Camouflage breaking**
- Depth lacks details (vs. color vision), but is more robust to illumination and condition changes – **robotics** and **autonomous driving**
- Depth is a **physical quantity**, and therefore models developed in simulators transform to real world (**Sim-to-Real**)

¹ V. Nityanda and J.C.A. Read: "Stereopsis in animals: evolution, function and mechanisms" J Exp Biol. (2017)



Why to add depth - RGB vs. Depth DiMP

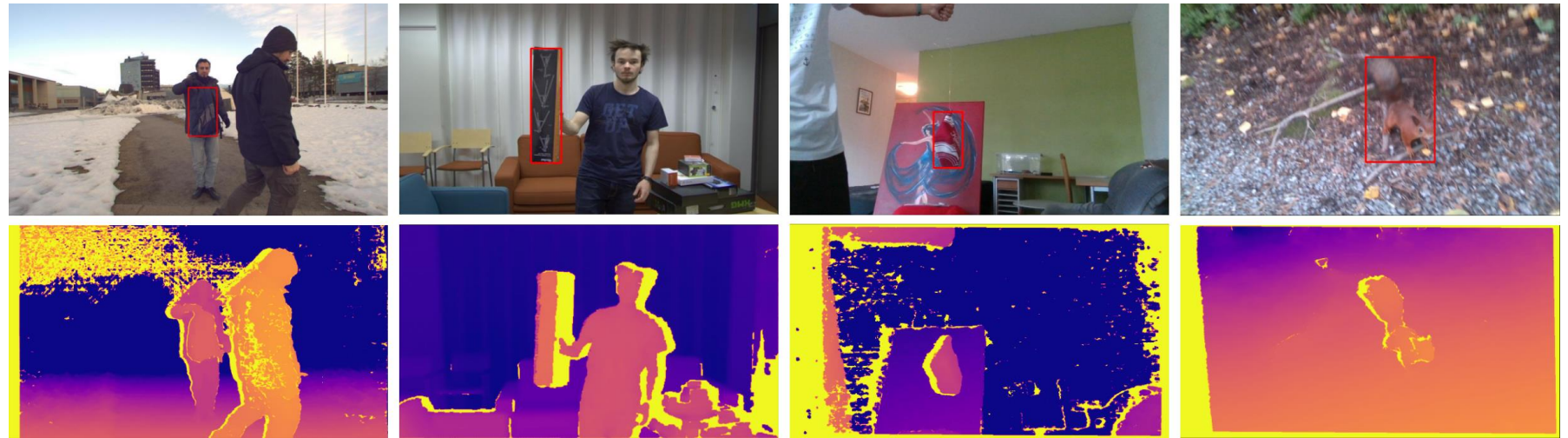


RGB is better (ratio < 1.0) in 80% of the sequences, but for a substantial part of them D is almost equally good (and our Depth-DiMP is not even trained with real depth tracking data)

Depth is better (ratio > 1.0) in 20% of the sequences

New in VOT-RGBD2022

- 1 Switched from the long-term (LT) to the short-term (ST) protocol: accuracy, robustness, and expected average overlap (EAO) of BBs
- 2 Dept-only track was added to promote *depth object tracking*
- 3 New data that combines CDTB and DepthTrack-test sequences to 127 ST sequences



VOT-RGBD2022 and VOT-D2022 Results

VOT-RGBD from 2019 to 2022

- 2019 – 4 valid entries
- 2020 – 4 valid entries
- 2021 – 5 valid entries
- 2022 – 8 valid entries (DMTracker, keep_track, MixForRGBD, OTrack, ProMix, SAMF, SBT_RGBD, and SPT)
- 2022 (D): 6 valid entries (CoDeT, MixFormerD, OTrack_D, RS-DiMP, SBT_Depth, and UpDoT)

Results

Tracker	EAO	A	R
1. ● MixForRGBD	0.779 ^①	0.816	0.946
2. ✚ SAMF	0.762 ^②	0.807	0.936
3. ✘ OTrack	0.729 ^③	0.808	0.894
4. ▶ ProMix	0.722	0.798	0.900
5. ▲ SBT_RGBD	0.708	0.809	0.864
6. ◻ DMTracker	0.658	0.758	0.851
→ 7. ★ DeT_DiMP50_Max	0.657	0.760	0.845
8. ● SPT	0.651	0.798	0.851
→ 9. ✚ STARK_RGBD	0.647	0.803	0.798
10. ✘ keep_track	0.606	0.753	0.797
11. ▶ DRefine	0.592	0.775	0.760
12. ▲ ATCAIS	0.559	0.761	0.739
13. ● DiMP	0.534	0.703	0.731
14. ★ ATOM	0.505	0.698	0.688

Table 7. Results for the eight submitted VOT-RGBD2022 trackers. For comparison, the table also includes the results for the three best performing RGBD trackers from VOT2020 (ATCAIS) and VOT2021 (STARK_RGBD and DRefine), two strong baseline RGB trackers from the previous years (DiMP and ATOM) and the baseline RGBD tracker from the DepthTrack dataset (DeT_DiMP50_Max [62]).

Tracker	EAO	A	R
1. ● MixFormerD	0.600 ^①	0.758	0.806
2. ✚ RSDiMP	0.573 ^②	0.734	0.759
3. ✘ OTrack_D	0.568 ^③	0.735	0.774
→ 4. ▶ DOT	0.469	0.672	0.673
5. ▲ SBT_Depth	0.462	0.756	0.571
6. ◻ UpDoT	0.439	0.652	0.627
7. ★ CoDeT	0.372	0.597	0.594
→ 8. ● DiMP	0.336	0.623	0.496

Table 8. Results for the six submitted VOT-D2022 trackers. For comparison, the table also includes the results for the recent dept-only tracker DOT [63] and RGB DiMP that was trained with RGB but tested with colormap converted depth images.



VOT-RGBD
Winners:

MixForRGBD by [Simiao Lai](#),
[Ming Li](#), [Jiawen Zhu](#), [Lijun Wang](#), [Dong Wang](#), [Huchuan Lu](#)

“End-to-End Tracking with Iterative
Mixed Attention for RGBD Tracking”



VOT-D
Winners:

MixFormerD by [Simiao Lai](#),
[Jiawen Zhu](#), [Lijun Wang](#),
[Dong Wang](#), [Huchuan Lu](#)
“End-to-End Tracking with Iterative
Mixed Attention for Depth-only
Tracking”

Winners talks in Session III
(16:35-18:00, GMT+2 time zone)

Summary

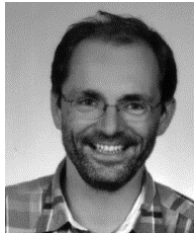
- Transformers became the **dominant methodology**
- Depth branches were trained with depth data only - »Depth backbones« will replace the RGB backbones
- Perhaps an interesting sub-topic for future is to find an **optimal representation of depth** for tracking

Thanks

- The VOT2022 committee



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H. J. Chang



R. Pflugfelder



G. Fernandez



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M. Felsberg



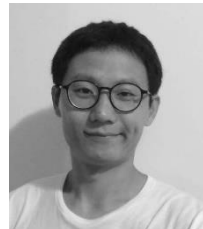
M. Danelljan



O. Drbohlav



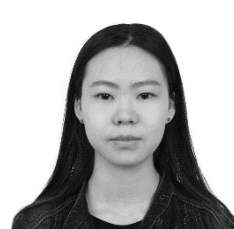
Z. Zhang



Y. Song



Wenyan Yang



Z. Yushan



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- VOT2022 sponsor:



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