

Object Tracking in Panoramic Videos

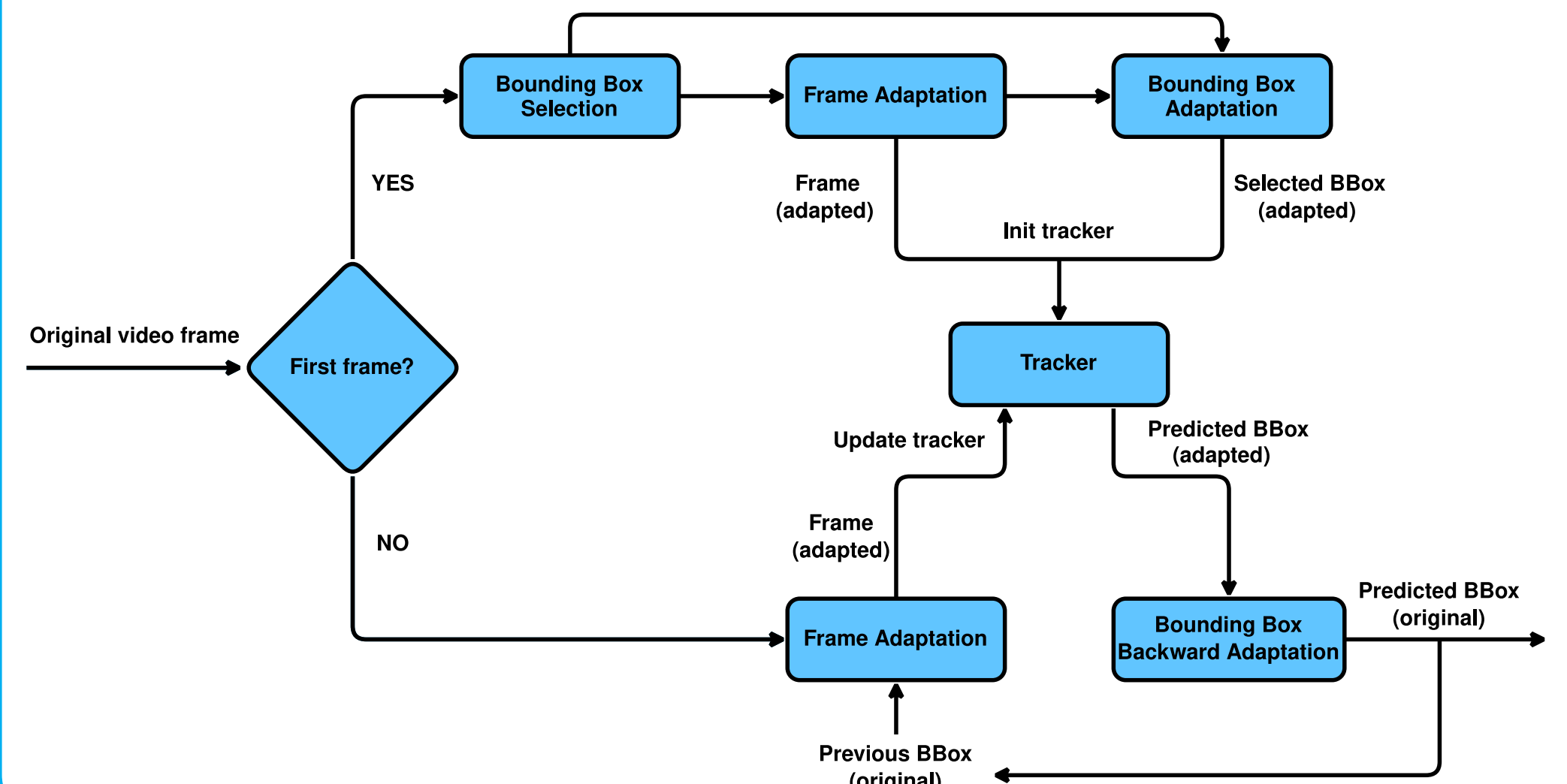
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Single Object Tracking (SOT) in 360° video

- The distortion occurs in $360^\circ \times 180^\circ$ panoramic projections
- Equirectangular projection is one of the most used mappings
- SOT is very challenging in equirectangular projection
 - radial distortion of tracked object
 - object can cross horizontal borders of equirectangular frame
 - > trackers can fail or predict false positive results
- We have provided 2 approaches based on frames adaptation
 - Equirectangular rotation (BORDER)
 - Normal Field Of View approach (NFOV)
- We have evaluated BORDER and NFOV improvements
 - 12 trackers
 - new manually created dataset with 360° videos
 - IoU (Intersection over Union) and Location Error metrics

Adaptation of equirectangular frames



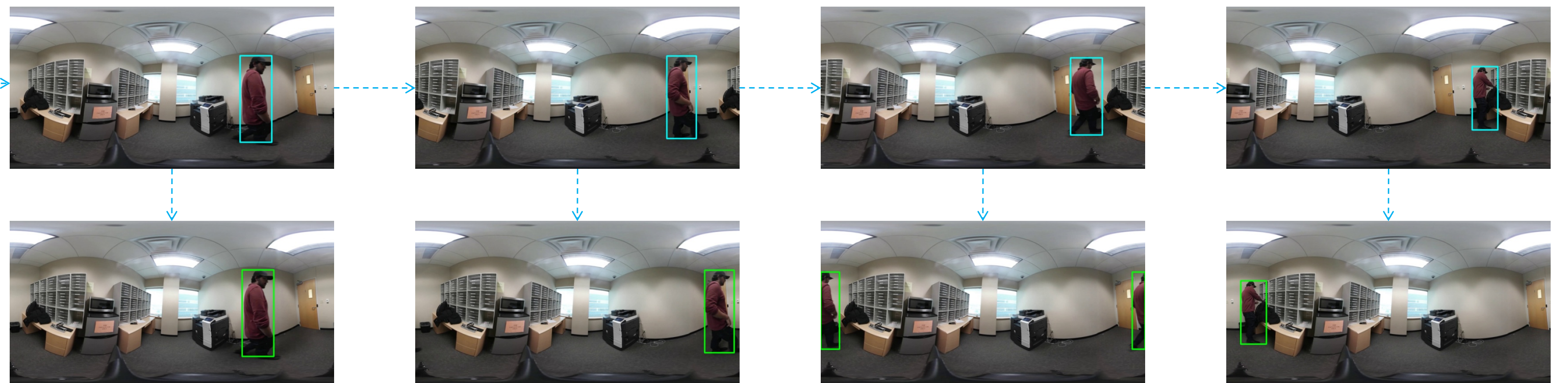
DEFAULT version

- Default version of single object tracker does not solve the border crossing problem



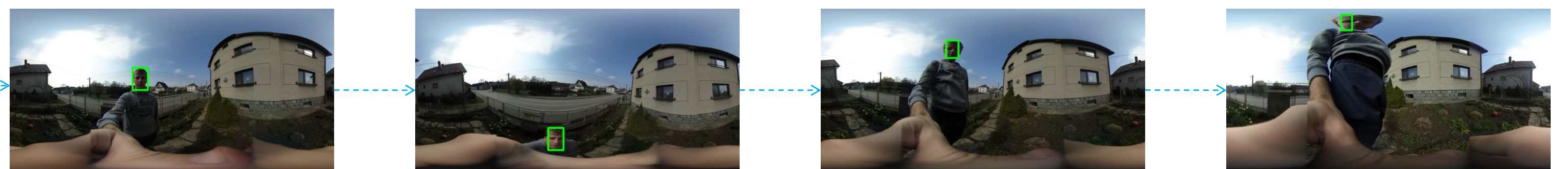
BORDER improvement

- We have provided the solution with the equirectangular rotation that corresponds to the spherical rotation about z-axis (Yaw)
- The rotation starts when the tracked object gets close to the horizontal border



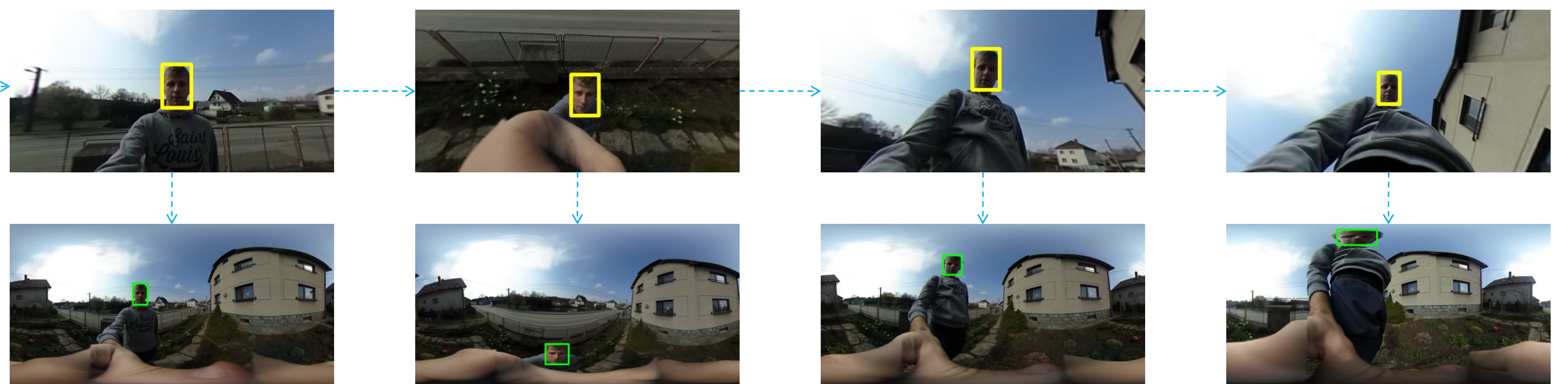
DEFAULT version

- Default version of tracker performs inaccurate results in highly distorted areas



NFOV improvement

- The tracker predicts results in rectilinear/perspective projection
- The virtual camera with the limited field of view (90° - 144°)
- NFOV approach solves the border crossing problem as well



Evaluation dataset – 21 panoramic videos in equirectangular projection with 9909 annotated frames

- The evaluation was performed for DEFAULT, BORDER and NFOV versions of 12 trackers
 - MIL (CVPR 2009), MEDIANFLOW (ICPR 2010), TLD (TPAMI 2011), KCF (TPAMI 2015), CSRT (CVPR 2017), ECO (CVPR 2017), DaSiamRPN (ECCV 2018), SiamDW (CVPR 2019), ATOM (CVPR 2019), DiMP (ICCV 2019), KYS (ECCV 2020), Ocean (ECCV 2020)

