Weekly Progress Report

Nov 01 - 05th, 2021

Presented by Yannis (Yiming) He 84189287

Noah's Ark | Autonomous Driving Lab
LiDAR Domain Adaptation

Manager: Bingbing Liu 00435285
Supervisor: Eduardo Corral Soto 00407762

Weekly Summary

- **Done:**
  - Experiment on effect after ONCE_rotation_fixed (Oracle & naive DA on m2)
    - Drop in performance.
    - Investigation on configuration: learning rate is making a great difference
    - With lr: 0.072 → 0.006
      - Oracle improved ~5 times (5.32 → 25.6)
      - Naive DA on m2 improved (0.03 → 3.3)
  - Experiment on Xingxin's code base (Oracle & naive DA on m2)
    - Current best performance on ONCE oracle, BUT got ~0 for naive DA to m2
    - Investigation on configuration: learning rate is making a great difference
      - Oracle: 25.6 → 34.1
      - Naive DA on m2: 3.3 → 0.07
- **In Progress:**
  → - Investigate why the inverse performance (oracle vs naive) occurred
    - Code, configuration, etc.
  - Region of Interest (ROI):
    - Evaluate P40 with ROI_x_flip_prob = 0.5 on M2 dataset
  - Visualization every frame BEV
    - to understand the false positive/negative
- **Recent Goals:**
  - Development: Plot mAP for all checkpoint for each class
- **TODO**:
  - Understanding: once_metric vs kitti metric
    - Prepare a decision diagram & flowchart for testing pipeline
  - Visualize frames having good and bad performances
    - Investigate correlation between performance & bbox (in progress)
    - Run entire pipeline with each frame individually (TODO)
    - Rank frames by AP (TODO)
    - Visualize frame with high & low AP (TODO)

Work Logs

Measured value
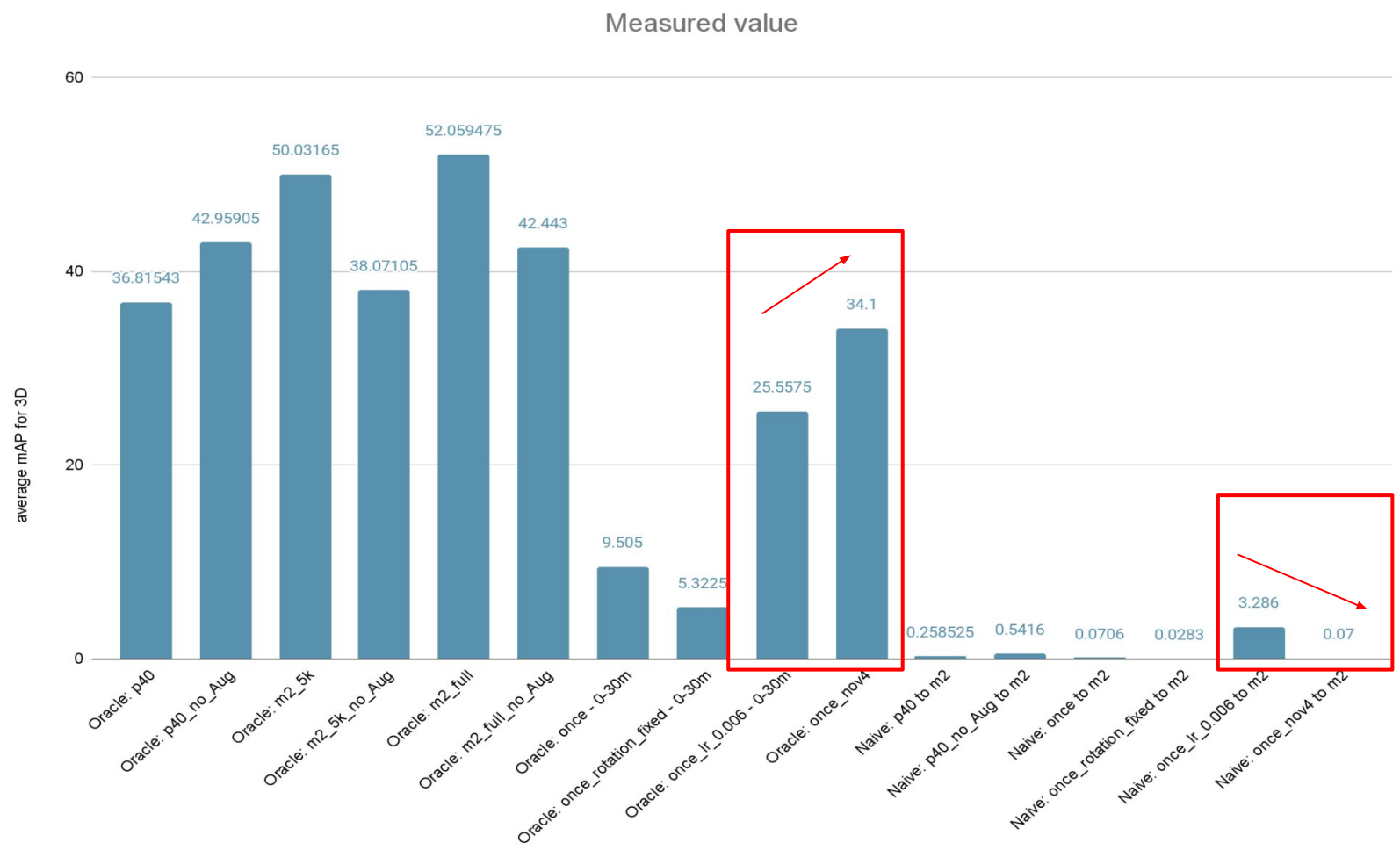
Work Logs

- Nov 01 (Monday)
    - Investigation on training:
        - P40 new vs old code base:
            - Unstable training
            - Bug:
                - "Cannot perform reduction function max on tensor with no elements because the operation does not have an identity at …"
            - Worse performance
        - ONCE before vs after rotation fixed:
            - Worse performance, not on the same scale with what Xingxin got
        - ROI:
            - dimension unmatch
    - Development: Plot mAP for all checkpoint for each class

Work Logs

- Nov 02 (Tuesday)
    - Investigation on training:
        - P40 new vs old code base:
            - Unstable training
            - Bug:
                - "Cannot perform reduction function max on tensor with no elements because the operation does not have an identity at …"
            - Worse performance
    - Experiment on effect after ONCE_rotation_fixed (Oracle & naive DA on m2)
        - Got worse performance.
        - Investigation on configuration: learning rate is making a great difference
        - With lr: $0.072 \rightarrow 0.006$
            - Oracle improved ~5 times ($5.32 \rightarrow 25.6$)
            - Naive DA on m2 improved ($0.03 \rightarrow 3.3$)
        - ROI:
            - dimension unmatch
    - Development: Plot mAP for all checkpoint for each class

Work Logs

- Nov 03 (Wednesday)
    - Investigation on training:
        - P40 new vs old code base:
            - Unstable training
            - Bug:
                - "Cannot perform reduction function max on tensor with no elements because the operation does not have an identity at …"
            - Worse performance
    - Experiment on effect after ONCE_rotation_fixed (Oracle & naive DA on m2)
        - Got worse performance.
        - Investigation on configuration: learning rate is making a great difference
        - With lr: 0.072 → 0.006
            - Oracle improved ~5 times (5.32 → 25.6)
            - Naive DA on m2 improved (0.03 → 3.3)
        - ROI:
            - dimension unmatch
    - Development: Plot mAP for all checkpoint for each class

Work Logs

- Nov 04 (Thursday)
    - Investigate the ROI
    - Modify the experimental set up to work with reverted rotation angle
    - Debug P40 for cuda error
- Nov 05 (Friday)
    - Create docker for ROI project and Xingxin's codebase
    - Run sample experiment on new docker to confirm consistent performances similar to previous environment

End of November 05th, Weekly Report

Weekly Progress Report

Nov 08 - 12th, 2021

Presented by Yannis (Yiming) He 84189287

Noah's Ark | Autonomous Driving Lab
LiDAR Domain Adaptation

Manager: Bingbing Liu 00435285
Supervisor: Eduardo Corral Soto 00407762

HUAWEI

Weekly Summary

- **Done:**
    - Investigate why the inverse performance (oracle vs naive) occurred
        - Xingxin's codebase hasn't invert the rotation angle from 90 to -90 degree
    - Synced Xingxin's changes for p40
    - Investigated the inverse behavior for rotation → +90 degree is the correct one
    - Experiment: ONCE with ~~corrected~~ rotation angle (-90) and perform oracle and naive DA on m2
    - Experiment: ONCE with corrected rotation angle (+90) and offset = 0
    - Experiment: P40, original ROI + resampling for missing gt_box
- **In Progress:**
    - Region of Interest (ROI):
    ➡️   - Debug ROI, studying the code (half way through)
            - Evaluate P40 with ROI_x_flip_prob = 0.5 on M2 dataset
    - Visualization every frame BEV
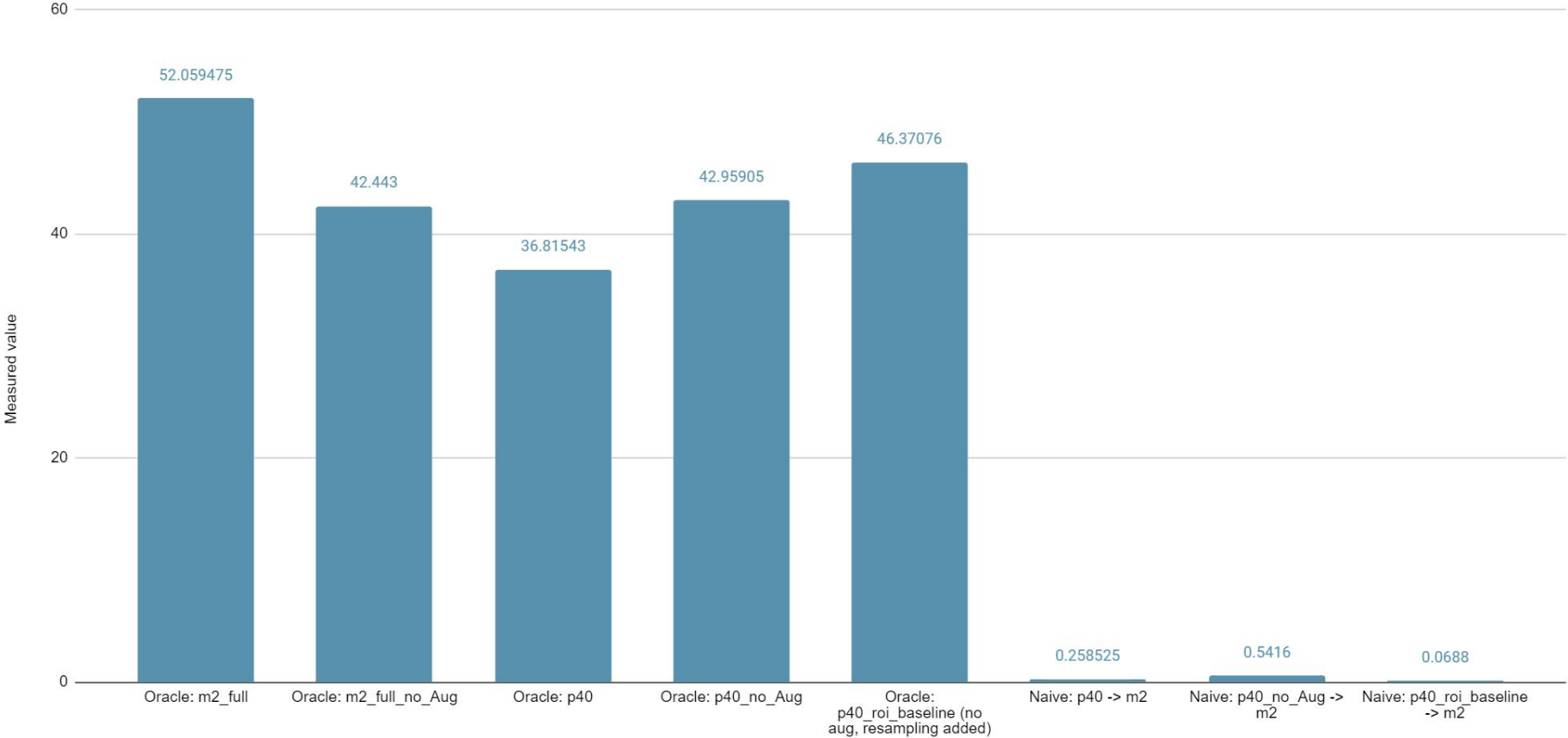   - to understand the false positive/negative
- **Recent Goals:**
    - Development: Plot mAP for all checkpoint for each class
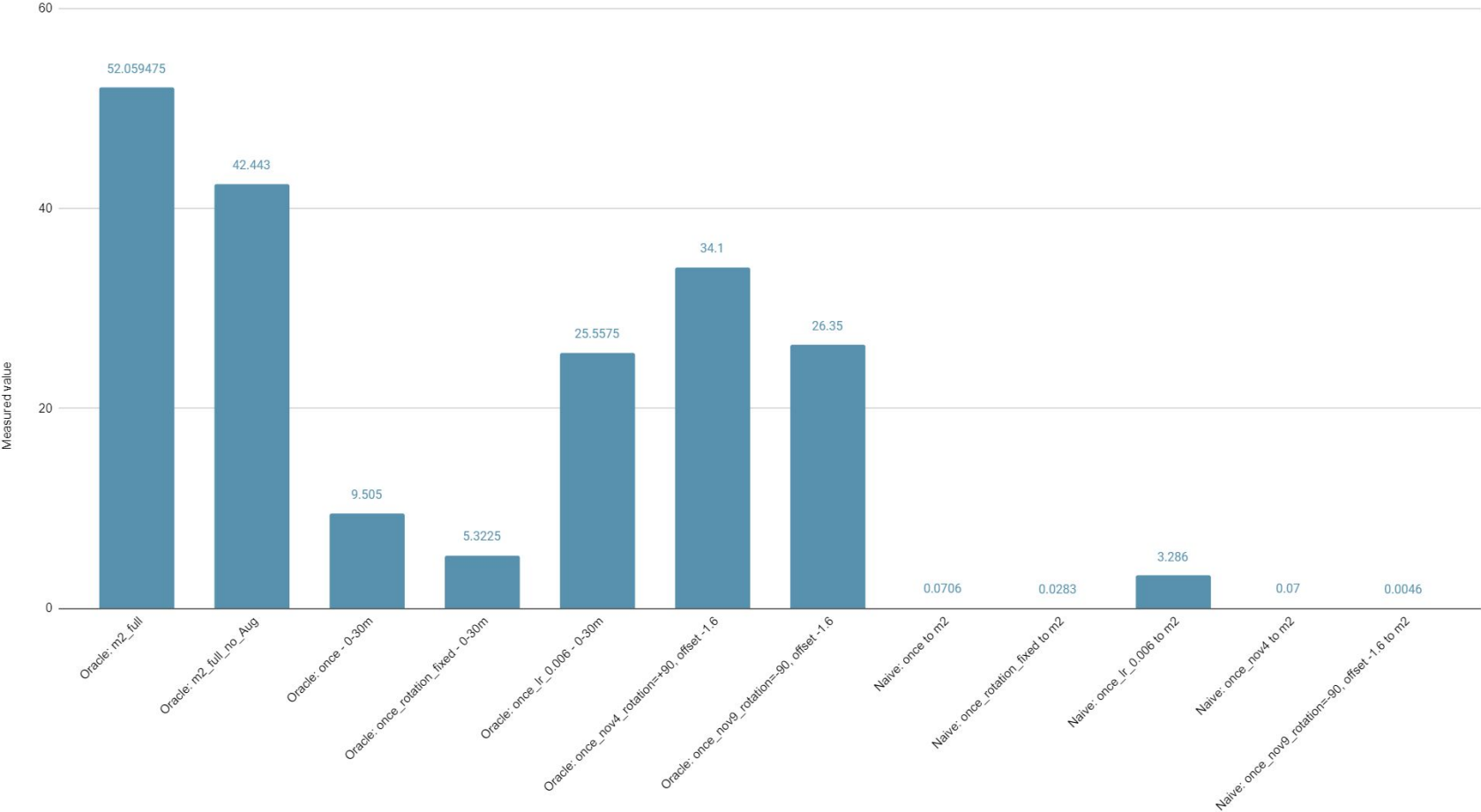- **TODO**:
    - Understanding: once_metric vs kitti metric
        - Prepare a decision diagram & flowchart for testing pipeline
    - Visualize frames having good and bad performances
        - Investigate correlation between performance & bbox (in progress)
        - Run entire pipeline with each frame individually (TODO)
        - Rank frames by AP (TODO)
        - Visualize frame with high & low AP (TODO)

P40 Measured value

52.059475	42.443	36.81543	42.95905	46.37076	0.258525	0.5416	0.0688
Oracle: m2_full	Oracle: m2_full_no_Aug	Oracle: p40	Oracle: p40_no_Aug	Oracle: p40_roi_baseline (no aug, resampling added)	Naive: p40 -> m2	Naive: p40_no_Aug -> m2	Naive: p40_roi_baseline -> m2

ONCE dataset

Work Logs

- Nov 08 (Monday)
    - Investigate why the inverse performance (oracle vs naive) occurred: code, configuration, etc.
        - Trained function (no difference)
        - Configuration
            - Data processor
                - Xingxin:
                    - Offset: [0, 0, -1.6]
                    - Rotation: 1.5708
                - Yannis:
                    - Offset: [0, 0, 0]
                    - Rotation: -1.5708
- Nov 09 (Tuesday)
    - Trained once with "Offset: [0, 0, -1.6] & Rotation: -1.5708" (GPU 4,5,6)
        - Result: worse performance in oracle when having -90 degree
            - Discussing with group, +90 should be the correct one
    - Experiment on the effect of offset
    - Run p40 with resampling embedded

Work Logs

- Nov 10 (Wednesday)
    - Get project comparison software
    - Experiment: ONCE with ~~corrected~~ rotation angle (-90) and perform oracle and naive DA on m2
    - Experiment: P40, original ROI + resampling for missing gt_box
- Nov 11 (Thursday)
    - Investigate the effect of offset:
        - Experiment with offset = 0 vs -1.6 for each rotation setting (+- 90)
    - Experiment ROI baseline
        - Oracle & naive on m2
- Nov 12 (Friday)
    - Debugged ROI POINT_CLOUD_RANGE from crashing caused by dimension unmatch
        - Experiment on modifying POINT_CLOUD_RANGE and learn the pattern
        - Go through code base and check computation
        - Research on original repo
    - Paper selection for Next Friday's paper reading session

End of November 12th, Weekly Report

Weekly Progress Report

Nov 15 - 19th, 2021

<u>Presented by Yannis (Yiming) He 84189287</u>

Noah's Ark | Autonomous Driving Lab
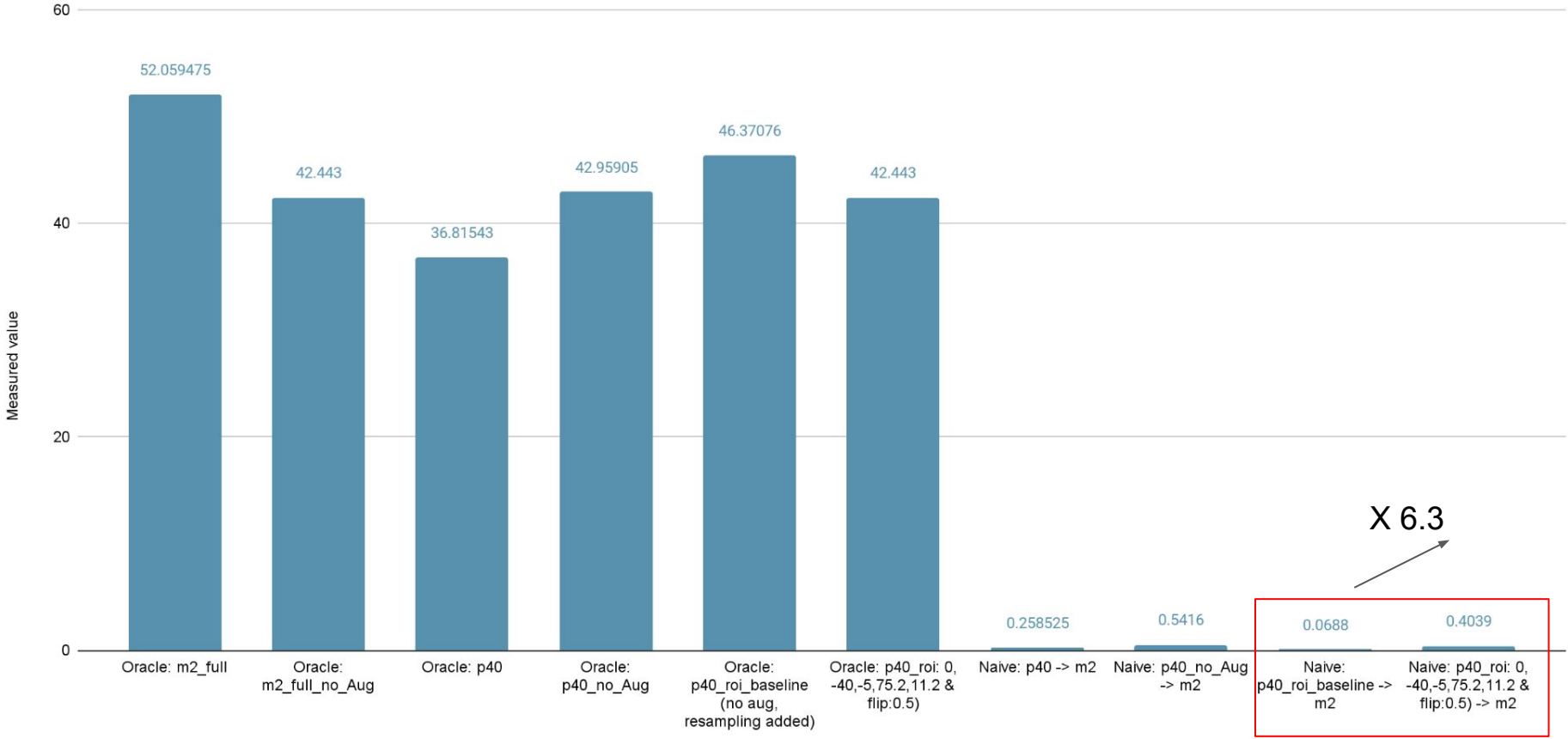LiDAR Domain Adaptation

Manager: Bingbing Liu 00435285
Supervisor: Eduardo Corral Soto 00407762

Weekly Summary

- **Done:**
    - Investigate why the inverse performance (oracle vs naive) occurred
        - Code, configuration, etc.
    - Debugged ROI POINT_CLOUD_RANGE from crashing caused by dimension unmatch
    - Selected 2-3 papers for paper reading session on Nov 19
    - Oracle & Naive experiment for P40 with ROI_x_flip_prob = 0.5 on M2 dataset (gpu 0,1,2,3)
    - Analyze papers and Create slides for paper reading session
- **In Progress:**
    - Region of Interest (ROI):
        - Train P40 with densified point clouds with new ROI with/without augmentation
- **Recent Goals:**
    - Visualization every frame BEV
        - to understand the false positive/negative
- **TODO**:
    - Understanding: once_metric vs kitti metric
        - Prepare a decision diagram & flowchart for testing pipeline
    - Development: Plot mAP for all checkpoint for each class
    - Visualize frames having good and bad performances
        - Investigate correlation between performance & bbox (in progress)
        - Run entire pipeline with each frame individually (TODO)
        - Rank frames by AP (TODO)
        - Visualize frame with high & low AP (TODO)

P40 Measured value

Bar	Measured value
Oracle: m2_full	52.059475
Oracle: m2_full_no_Aug	42.443
Oracle: p40	36.81543
Oracle: p40_no_Aug	42.95905
Oracle: p40_roi_baseline (no aug, resampling added)	46.37076
Oracle: p40_roi: 0, -40,-5,75.2,11.2 & flip:0.5)	42.443
Naive: p40 -> m2	0.258525
Naive: p40_no_Aug -> m2	0.5416
Naive: p40_roi_baseline -> m2	0.0688
Naive: p40_roi: 0, -40,-5,75.2,11.2 & flip:0.5) -> m2	0.4039

X 6.3

Work Logs

- Nov 15 (Monday)
  - Debugged ROI POINT_CLOUD_RANGE from crashing caused by dimension unmatch
    - POINT_CLOUD_RANGE: [0, -40, -5, 75 , 10 , 7]
      >>
    - POINT_CLOUD_RANGE: [0, -40, -5, 75.2, 11.2, 7]
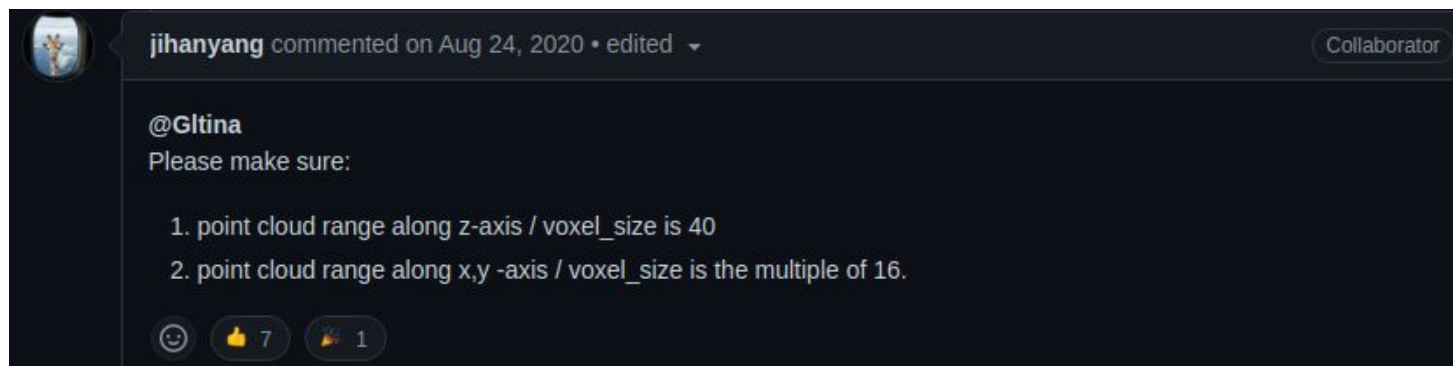
- Selected 2-3 papers for paper reading session on Friday
- Met Eduardo after meeting for next step discussion

Work Logs

- Nov 16 (Tuesday)
    - Papers selection, with official code:
        - Self-Supervised Pillar Motion Learning for Autonomous Driving
        - Visualizing Adapted Knowledge in Domain Transfer
        - Regressive Domain Adaptation for Unsupervised Keypoint Detection
        - Towards Semantic Segmentation of Urban-Scale 3D Point Clouds: A Dataset, Benchmarks and Challenges

Work Logs

- Nov 17 (Wednesday) (cont')
    - Papers selection, No official code:
        - DRANet: Disentangling Representation and Adaptation Networks for Unsupervised Cross-Domain Adaptation
        - Continual Adaptation of Visual Representations via Domain Randomization and Meta-learning
        - Source-Free Domain Adaptation for Semantic Segmentation
        - GeoSim: Realistic Video Simulation via Geometry-Aware Composition for Self-Driving
        - Informative and Consistent Correspondence Mining for Cross-Domain Weakly Supervised Object Detection
        - Generalized Domain Adaptation
        - Self-adaptive Re-weighted Adversarial Domain Adaptation
        - DA-DETR: Domain Adaptive Detection Transformer by Hybrid Attention
    - Next step:
        - Eduardo will use his model-free python code to densify p40 point cloud (To be received)
        - Train p40 on the densified point cloud without augmentation (except for vertical flipping)
        - Train p40 with augmentation (only insertion of GT object)
            - Need to run python script to generate object database

Work Logs

→ Nov 18 (Thursday)
- Experiment: Naive DA: p40 (roi: 0,-40,-5,75.2,11.2 & flip:0.5)
  - Improvement:
    - Baseline mAP: 0.0688
- Current mAP: 0.4039 (626%)
- Papers selection:
  - ✓ - Unsupervised Domain Adaptation in Semantic Segmentation via Orthogonal and Clustered Embeddings
  - - Self-Adversarial Disentangling for Specific Domain Adaptation
  - - Semi-supervised Domain Adaptation based on Dual-level Domain Mixing for Semantic Segmentation
  - ✓ - Target-targeted Domain Adaptation for Unsupervised Semantic Segmentation
- Analyze papers and Create slides for paper reading session
- Met with Yang to discuss Carla's vs P40&ONCE's performance for M2 Naive DA

Work Logs

➡ Nov 19 (Friday)
- Slides & Paper sharing presentation
- Region of Interest (ROI):
  - Train P40 with densified point clouds with new ROI with/without augmentation

End of November 19th, Weekly Report

Weekly Progress Report

Nov 22 - 26th, 2021

Presented by Yannis (Yiming) He 84189287

Noah's Ark | Autonomous Driving Lab
LiDAR Domain Adaptation

Manager: Bingbing Liu 00435285
Supervisor: Eduardo Corral Soto 00407762

HUAWEI

Weekly Summary

- **Done:**
  - Region of Interest (ROI):
    - Trained P40 with densified point clouds with new ROI without augmentation
  - Investigated m2 evaluation performance difference with different configuration (Yang's configuration vs mine)
  - Region of Interest (ROI):
    - Evaluate P40 with densified point clouds with new ROI without augmentation
    - Train P40 with pointcloud z_offset = -0.6
- **In Progress:**
  - Region of Interest (ROI):
    - Comparing performance with Aich's code base
    - Generate info files for non-augmentation training
  - Research state-of-the-art domain adaptation technique for potential individual research direction
- **Recent Goals:**
  - Train p40 with augmentation (only insertion of GT object)
  - Visualization every frame BEV
    - to understand the false positive/negative
- **TODO:**
  - Understanding: once_metric vs kitti metric
    - Prepare a decision diagram & flowchart for testing pipeline
  - Development: Plot mAP for all checkpoint for each class
  - Visualize frames having good and bad performances
    - Investigate correlation between performance & bbox (in progress)
    - Run entire pipeline with each frame individually (TODO)
    - Rank frames by AP (TODO)
    - Visualize frame with high & low AP (TODO)

Work Logs

- Nov 22 (Monday)
    - Region of Interest (ROI):
        - Train P40 with densified point clouds with new ROI without augmentation (gpu: 0-3)
        - Generate info files for augmentation training
            - Need to run python script to generate object database
    - Research state-of-the-art domain adaptation technique for potential individual research direction
    - Meeting Yang
- Nov 23 (Tuesday)
    - Meeting with Yang to discuss difference in m2 evaluation
    - Meeting with Thomas:
        - Rank board model
            - Runtime (10Hz)
            - Performance
        - Find a topic
        - Innovation:
            - Training technique, data augmentation, loss function, module, etc
        - Find a baseline
            - Code

Work Logs

- Nov 24 (Wednesday)
    - Region of Interest (ROI):
        - Train P40 with densified point clouds with new ROI without augmentation (gpu: 0-3)
        - Train P40 with pointcloud z_offset = -0.6
        - Generate info files for augmentation training
        - Compare Aich's configuration
        - Study code for info file generation
    - Research paper reading
- Nov 25 (Thursday)
    - Region of Interest (ROI):
        - Test previous p40 model on roi_dense codebase
    - Download Aich's codebase
    - Evaluate P40 with z_offset = -0.6
    - Debug nms_min_radius → the hyper-parameter itself doesn't get called. However, changing the value causes parameter loading error
- Nov 26 (Friday)
    - Meeting with Aich, Eduardo, Xingxin, Yang for reproducing Aich's result
    - Train ONCE Oracle
    - Generate info files for dense p40 dataset (Thanks Xingxin for helping)

End of November 26th, Weekly Report

Weekly Progress Report

Nov 29 - Dec 3rd, 2021

Presented by Yannis (Yiming) He 84189287

Noah's Ark | Autonomous Driving Lab
LiDAR Domain Adaptation

Manager: Bingbing Liu 00435285
Supervisor: Eduardo Corral Soto 00407762

Weekly Summary

- **Done:**
    - Generated info files for dense p40
    - Get Aich's codebase to produce ONCE → M2 result
        - Compared Oracle performance with Aich's code base
        - Test naive performance
            - 80th epoch generated by trained
            - vs 80th epoch trained by Aich
            - vs 80th epoch RE-trained by Aich
- **In Progress:**
    - Get the newest codebase from Xingxin
    - P40 oracle training on undensified data (to make sure it's working)
    - Generate info files for NEW densified pointcloud (to be given by Eduardo)
    - Experiment on p40 densified pointcloud (baseline, ROI, z_offset, etc)
- **Recent Goals:**
    - Train p40 with augmentation (only insertion of GT object)
        - to understand the false positive/negative
- **TODO**:
    - Understanding: once_metric vs kitti metric
        - Prepare a decision diagram & flowchart for testing pipeline
    - Development: Plot mAP for all checkpoint for each class
    - Visualize frames having good and bad performances
        - Investigate correlation between performance & bbox (in progress)
        - Run entire pipeline with each frame individually (TODO)
        - Rank frames by AP (TODO)
        - Visualize frame with high & low AP (TODO)

Work Logs

➡️ Nov 29 (Monday)
- Use ONCE checkpoint epoch 80th given by Yang (trained by Aich) to evaluate on ONCE using ONCE metric
    - Compare results: Yang's vs Mine
- Evaluate ONCE checkpoint s on m2 for naive DA for both checkpoint
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End of December 3rd, Weekly Report