{\n "SummaryDoc": "# MapFusion: A General Framework for 3D Object Detection with HDMaps\n\n## Abstract\n\n3D object detection is a key perception component in autonomous driving. Traditional methods rely mostly on Lidar sensors or a combination with cameras. This paper introduces MapFusion, a framework designed to enhance 3D object detection by integrating High Definition Maps (HDMaps) into existing detection systems. MapFusion is independent of the detection models and demonstrates improved mean Average Precision (mAP) across different standards.\n\n## Introduction\n\nAutonomous driving technology has significantly advanced, yet challenges remain in perception systems essential for interpreting and interacting with the environment. While cameras are common, their 2D data lacks reliable depth information, necessitating robust 3D detection methods. This research focuses on enhancing LiDAR-based detection by leveraging HDMaps for improved object distinction and localization. [[FIGURE: page1\_img1.jpg | Caption: \"Comparison of detection results\" | Explanation: \"Figure 1a demonstrates limitations in current 3D detection resulting in false positives, while 1b shows reduced false positives using MapFusion, integrating HDMaps.\" | Ref: PDF p.1]]\n\n## Methodology\n\n### Architecture Overview\n\nMapFusion consists of two main components: FeatureAgg for extracting and fusing features from HDMaps, and MapSeg, an auxiliary segmentation head aiding the detection process. The integration aims to refine detection accuracy and reduce false positives and negatives. [[FIGURE: page2\_img2.jpg | Caption: \"Overview of the MapFusion framework\" | Explanation: \"The figure presents the modular design of MapFusion, where HDMaps features are combined with traditional voxel features to enhance detection reliability.\" | Ref: PDF p.2]]\n\n### HDMap Representation and Integration\n\nHDMaps provide precise road topology and geometry which are underutilized in conventional systems. MapFusion employs these maps to provide context and spatial cues which are crucial for accurate object recognition and localization.\n\n### FeatureAgg and MapSeg Modules\n\nThe FeatureAgg module merges voxel and map features efficiently, maintaining feature dimensionality. The MapSeg module predicts road structures directly from LiDAR, supervised by HDMaps to enhance the learning of relevant features. [[FIGURE: page3\_img3.jpg | Caption: \"Detailed architecture of FeatureAgg and MapSeg modules\" | Explanation: \"This figure outlines the internal workings of the FeatureAgg and MapSeg modules focusing on feature integration and road segmentation.\" | Ref: PDF p.3]]\n\n## Experimental Results\n\nWe evaluated MapFusion on the nuScenes dataset with various baseline detectors like SECOND, PointPillars, and CenterPoint. Results indicate improvements in detection metrics across the board. \*\*Table 1. Performance comparison on nuScenes dataset\*\*\n\n| Method | NDS (%) | mAP (%) | Improvement |\n|:------|---------:|---------:|------------:|\n| SECOND | 62.04 | 50.89 | \*\*+1.27\*\* |\n| PointPillars | 58.95 | 46.66 | \*\*+2.79\*\* |\n| CenterPoint | 67.97 | 60.61 | \*\*+1.18\*\* |\n\n## Conclusion\n\nMapFusion significantly enhances 3D object detection by integrating HDMaps into existing detection frameworks, improving accuracy and reducing errors. Future work will explore fusion with other sensor data and expand HDMaps applicability in areas where they are limited or unavailable.\n\n## References\n\n1. Yurtsever, E., Lambert, J., Carballo, A., & Takeda, K. (2020). A survey of autonomous driving: Common practices and emerging technologies. \*IEEE Access\*, 8, 58443-58469.\n\nMore references as listed in the original document."\n}