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AI applications for railway positioning and autonomous trains

The purpose of this research is to investigate how front-facing, train-mounted cameras and computer vision can be used to compensate for GPS inaccuracies. By using footage from track-recording cameras, computer vision can determine the number of tracks and the track occupancy of the train, which can compensate for GPS inaccuracies in the lateral positioning. GPS usage in railway applications is rare, however, an AI-based positioning system would facilitate the usage of GPS for higher capacity and better utilisation of current railway infrastructure. This is especially interesting for ERTMS, a European effort to create a standardised signalling system while simultaneously increasing capacity, where potential for an AI-based positioning system can be found in both ERTMS level 2 and level 3. Cameras provide track recordings continuously at any time, while immediately updating track occupancy in case of information loss. Since it provides continuous information about position, it complements GPS perfectly. Cameras can replace equipment in the track used for positioning (e.g. balises, track-circuits, axle counters), which reduces investment- and maintenance costs. Also, it can eliminate any signal failures caused by said track equipment, thereby increasing reliability and punctuality. This is crucial for passenger services, as increasing public trust in the railway system enhances competitiveness. Future applications for on-board cameras and computer vision, in addition to train track occupancy, include identification of switches, signals, signs, other rail vehicles, station platforms, obstacles etc. The potential for AI-based autonomous trains is huge, the whole railway network can be automated and streamlined enormously for a more competitive transportation mode, for a greener future.

