Optimization Report

Vehicle autonomy is critically dependent on an accurate identification and mathematical representation of road and lane geometries. Many road lane identification systems are ad hoc (e.g., machine vision and lane keeping systems) or utilize finely-discretized path data and vehicle tracking systems such as GPS. A novel Midwest Discrete Curvature (MDC) method is proposed in which geodetic road data is parsed along road directions and digitally stored in a road data matrix. Road data is discretized to geospatial points and curvature and road tangent vectorization, which can be utilized to generate consistent, mathematically-defined road profiles with deterministic boundary conditions, consistent non-holonomic boundary constraints, and a smooth, differentiable path which connects critical road coordinates. The method was evaluated by discretizing three road segments: a hypothetical road consistent with the American Association of State Highway and Transportation Officials (AASHTO) Green Book design standards, a road segment discretized using satellite photography and GPS data points, and an in-vehicle GPS trace collected at 10 Hz. Improvements and further research were recommended to expand findings, but results indicated potential for implementation into road modeling which could be the foundation of new autonomous vehicle guidance systems that are complimentary to existing autonomous systems.