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SciRob Intro - Outline

1. Autonomous vehicles rely on control systems to automate following of a desired trajectory. These control systems are presently designed around a physical model of the vehicle.

   Include references to several overview papers on path planning / control for autonomous vehicles

   Control systems for autonomous vehicles currently rely on a physics-based model either explicitly in the case of predictive control algorithms or implicitly for traditional feedforward-feedback architectures

   Control systems based on physical models have clear advantages and have demonstrated great performance under known driving conditions.

   Mention advantages of physics-based models: simplicity in terms of required parameters, intuition, and correctness from known first principles.

2. However, physics-based models have several drawbacks, particularly when operating conditions change or when dynamics are difficult to model.

   Physics-based models are designed around a particular set of parameters and a particular operating condition. These can often change in safety critical situations. Provide example of car designed around asphalt that suddenly encounters a low-friction surface.

   Designer must explicitly decide about model complexity and manually encode logic for multiple operating conditions.

   Certain physics that are critical for control can be prohibitive to model given difficulty of estimating parameters or hard-to-model physics (e.g. effect of suspension dynamics at the handling limits)

3. Given drawbacks of physics-based models, there has been increasing interest in developing data-driven models for automated systems.

   Reference prior art here - e.g. Punjani and Abbeel, Cole, Ghazizadeh, and papers that don't use neural networks (e.g. regression models, GPs, etc.)

   Research with neural networks dates back to early 1990's, but explosion of deep learning methods has created potential for models with even higher capacity

4. This paper contributes a novel neural network model for an automated vehicle.

   Describe contributions and differentiation from prior art