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| Application Domain | **Complex Problem Identified** | |  | | --- | |  |  |  | | --- | | **Justification** | |
| Healthcare (Medical Imaging) | Automatic Diagnosis via Deep Learning in Medical Imaging | Machine learning in medical imaging (radiology) is complex due to data variability, noisy data, and high accuracy demands in diagnosing diseases. Studies, such as those by Litjens et al. (2017), highlight the challenges of developing deep learning models that generalize well across diverse patient data. Ethical and interpretability issues further complicate this field. |
| Autonomous Systems (Robotics) | Human-Robot Interaction (HRI) and Ethical Decision-Making in Autonomous Robots | Cognitive and ethical decision-making in autonomous systems, particularly in situations like healthcare or defense, presents complexity due to unpredictable human behavior and moral dilemmas. Literature, including the works of Arkin (2009), argues that implementing moral algorithms in robots demands extensive ethical reasoning frameworks, increasing both computational and theoretical complexity. |
| Climate Modeling (Environmental Science) | Predictive Modeling of Extreme Weather Events Using AI and Climate Data | Predicting extreme weather events is difficult due to the chaotic nature of weather systems and incomplete data. According to Allen et al. (2014), current AI-based models need to balance high computational complexity with climate uncertainty to accurately simulate rare but catastrophic events. The fusion of large datasets and real-time data increases the computational burden and complexity of modeling these phenomena. |