**AI for Signal Classification in Wireless Systems**

**Problem Statement:**

The increasing complexity and density of modern wireless communication environments have made traditional signal classification methods inadequate, particularly in scenarios involving high interference, low signal-to-noise ratios (SNR), and diverse signal types. These conventional techniques often rely on handcrafted features and rigid statistical models, which lack adaptability, scalability, and robustness in dynamic wireless conditions.

Artificial Intelligence (AI), especially machine learning and deep learning, offers a transformative solution by enabling automatic feature extraction, pattern recognition, and adaptive learning directly from raw signal data. However, effectively integrating AI into wireless signal classification systems remains a significant challenge due to issues such as limited labeled data, model generalization across varying environments, real-time processing constraints, and interpretability of AI decisions. Therefore, the problem lies in developing AI driven signal classification models that are accurate, robust, data-efficient, and capable of real-time performance, to meet the demands of next-generation wireless communication systems.