



MoE-Gyro: Self-Supervised Over-Range Reconstruction and Denoising for MEMS Gyroscopes

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Introduction & Motivation

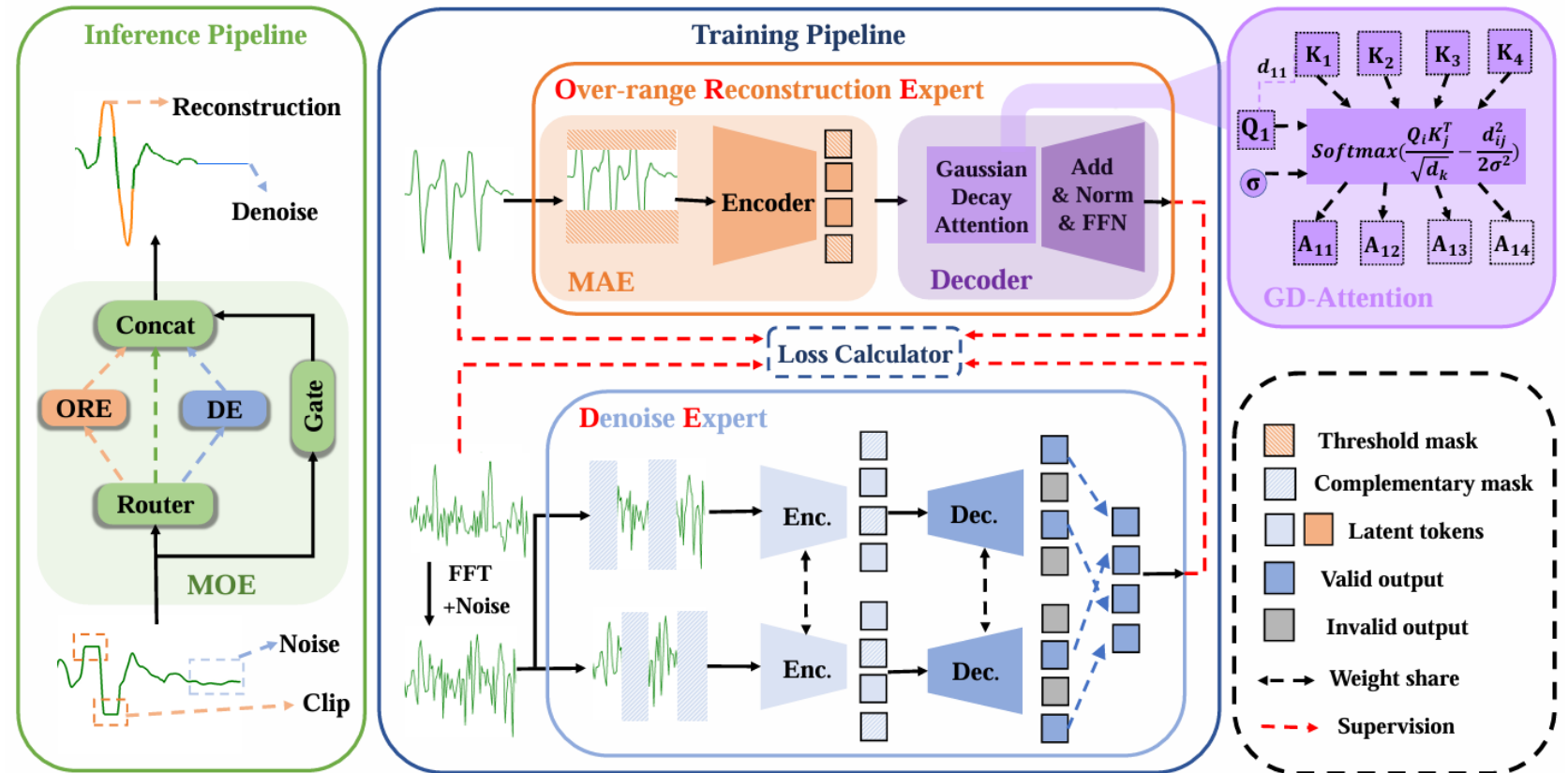


- **Core Conflict:** The fundamental trade-off in MEMS sensors.
 - High Measurement Range \longrightarrow High Noise
 - Low Noise \longrightarrow Limited Measurement Range
- **Existing Gaps:**
 - **Hardware Solutions:** Complex, costly, and hard to scale.
 - **Prior AI Methods:** Require expensive, fully-supervised data and don't solve the core range-noise trade-off.
- **Our Key Technical Challenge:** In a single model, large-scale Reconstruction gradients overwhelm subtle Denoising gradients

Method: MoE-Gyro

Our Solution: A Mixture-of-Experts (MoE) architecture for task decoupling.

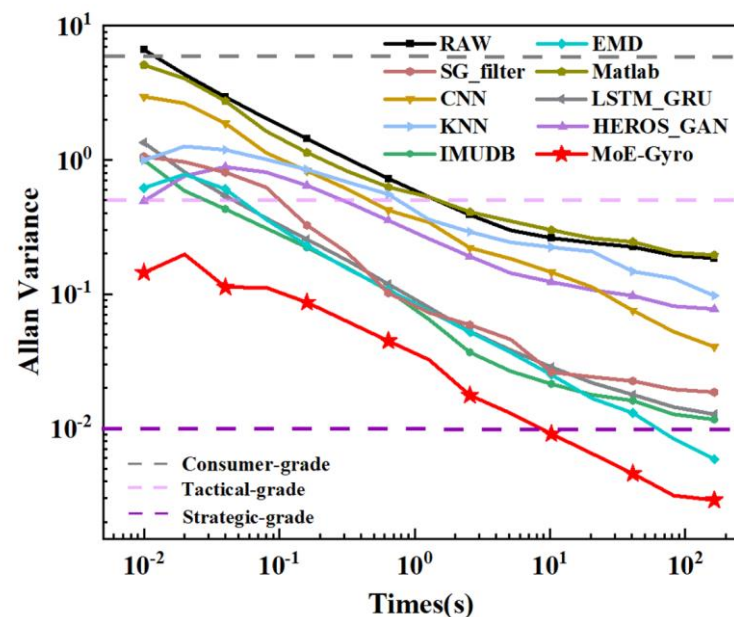
1. Intelligent Gating
2. Expert Processing
3. Concatenation



Key Experimental Results

Benchmark: We introduce **ISEBench** for IMU Signal Enhancement.

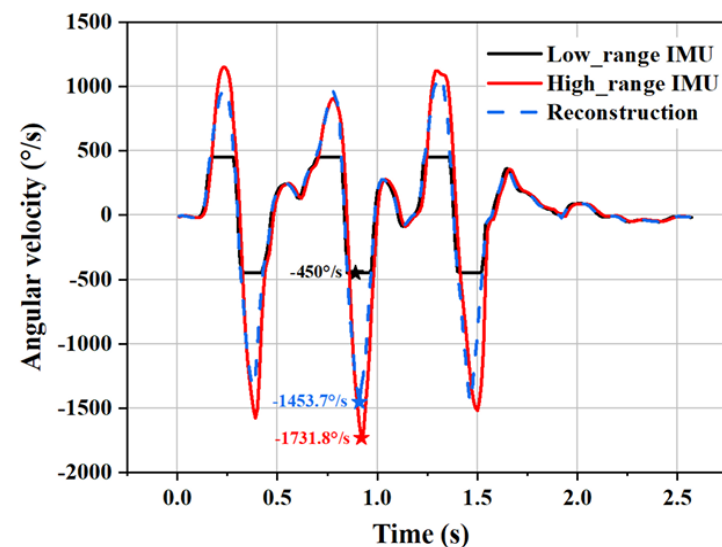
Denoising Performance:



MoE-Gyro achieves the best performance

Key Metric: 98.4% reduction in Bias Instability (BI)

Range Extension:



Extends measurable range from
 $\pm 450^{\circ}/s$ to $\pm 1500^{\circ}/s$

Conclusion



Contributions:

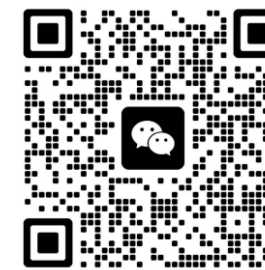
- **MoE-Gyro**: The first self-supervised MoE framework to simultaneously solve reconstruction and denoising
- **Broke the Trade-off**: We effectively broke the fundamental range-noise trade-off in MEMS sensors without hardware changes.
- **ISEBench**: Released the first open-source benchmark for IMU signal enhancement.

Code: <https://github.com/2002-Pan/Moe-Gyro>

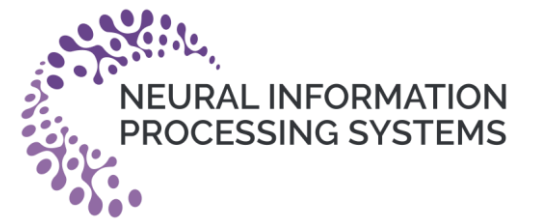
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Project



Wechat



Thanks