

Research framework: checking AI outputs in construction and building operations

Research question. Where should each check be placed: in training, before release, or with a human reviewer?

The answer depends on how completely the check can decide whether an output is correct.

	 (a) Perception On-site quality inspection	 (b) Decision-making Production and maintenance	 (c) Language models Maintenance and BIM
Period	2022–2026, Ph.D. at NTU	2026–present, SIT	2026–present, SIT
Method	Mixed reality with vision foundation models	Deep reinforcement learning, graph neural networks, multi-agent learning; learned dispatching policies, human-in-the-loop learning	Language model agents; a locally deployable language model with preference and reinforcement learning
AI output	Measured dimensions and rebar spacing	Production schedules for shared stations; work-order dispatch plans	Work-order schedules from a language model agent; natural-language edits to IFC models
Check	Engineering tolerances; engineer review on site	Feasibility under time lags, setups and availability windows; optimality bounds; priority-rule baselines on open benchmarks; supervisor overrides	Quality certificates; IFC verifier: geometry, semantics, topology
Used for	E Evaluation: pass or fail against tolerance H Human review: engineer confirms on site	T Training: bounds in reward design and credit assignment E Evaluation: comparison with priority rules H Human review: learning from supervisor overrides	R Release check: certificate before release T Training: data filtering, preference labels, reinforcement learning reward
Work	MR integration review • Dimensional QA with FastSAM • Gaze-driven timber inspection • Human-in-the-loop rebar inspection • ARMIS rebar spacing •	Time-lag-aware DRL • Scheduling review • PACT ○ BOLT ○	Open CMMS benchmark • FM-CrossTraining • Asset prioritization • SURGE ○ CertiGATE • VeriBIM ○

Future work: connecting production, construction and maintenance through a digital twin

Check
T Training
 R Release check
 E Evaluation
 H Human review
 • Published or accepted • Under review or revision ○ In preparation