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Reasoning Is All You Need For Urban Planning AI

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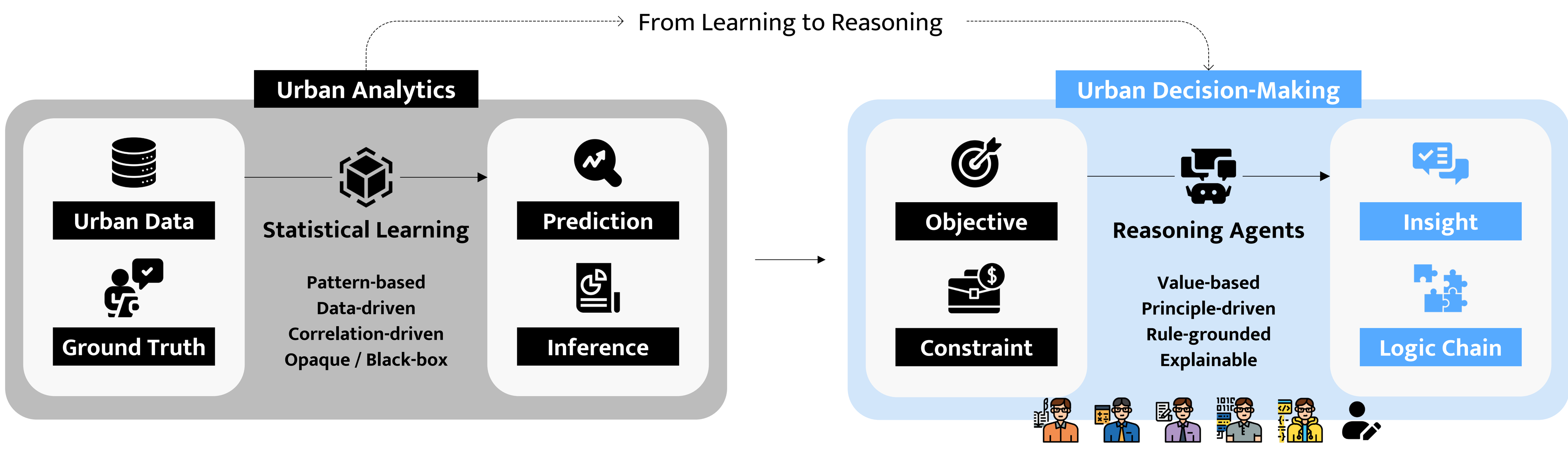
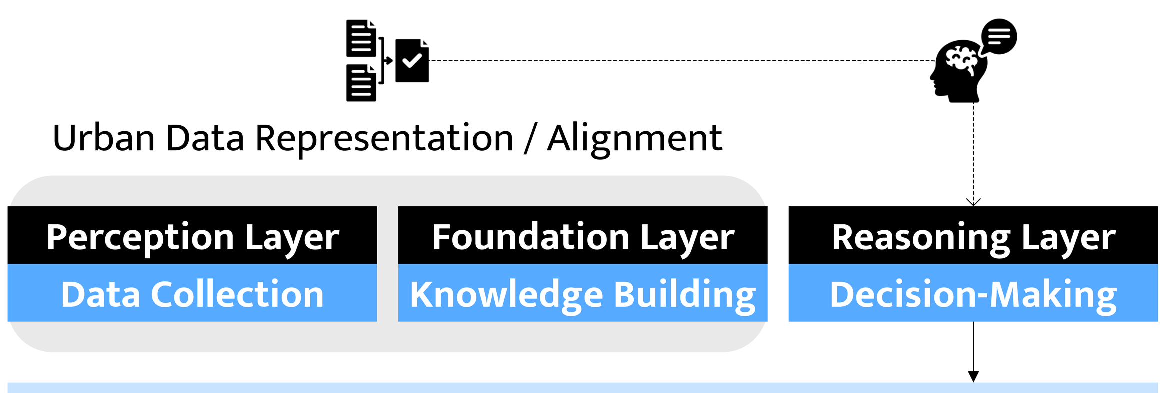


Statistical learning learns patterns from historical data via correlations.
---It predicts well, but decisions are often **opaque**.
---It can mimic past allocations and flag likely violations,
---yet struggles with **normative rules**, **hard constraints**, and **explainable reasoning**.

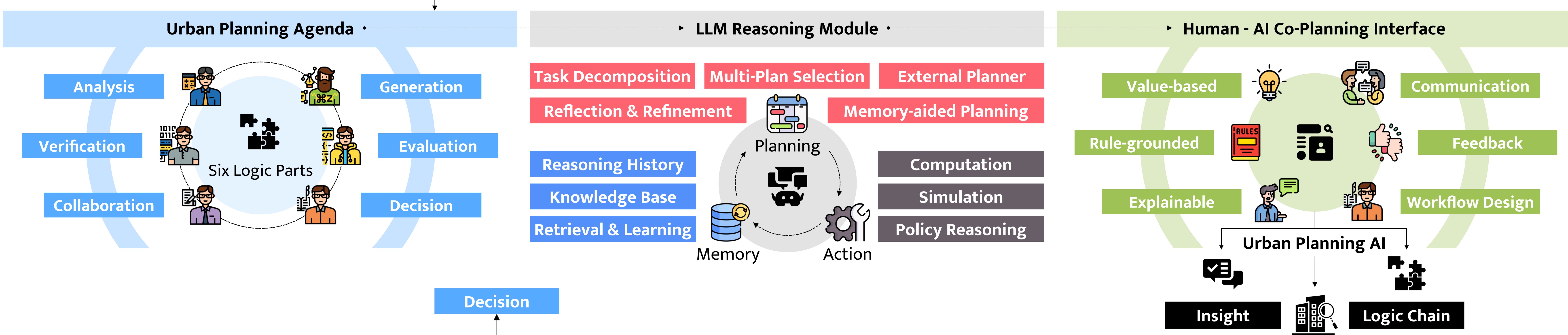
Reasoning agents generate decisions via **explicit reasoning traces** (e.g., CoT, ReAct).
—They reason step by step, making decisions transparent.
—They can apply normative rules and resolve conflicting principles,
—and explain **constraint satisfaction** and **counterfactual logic**.

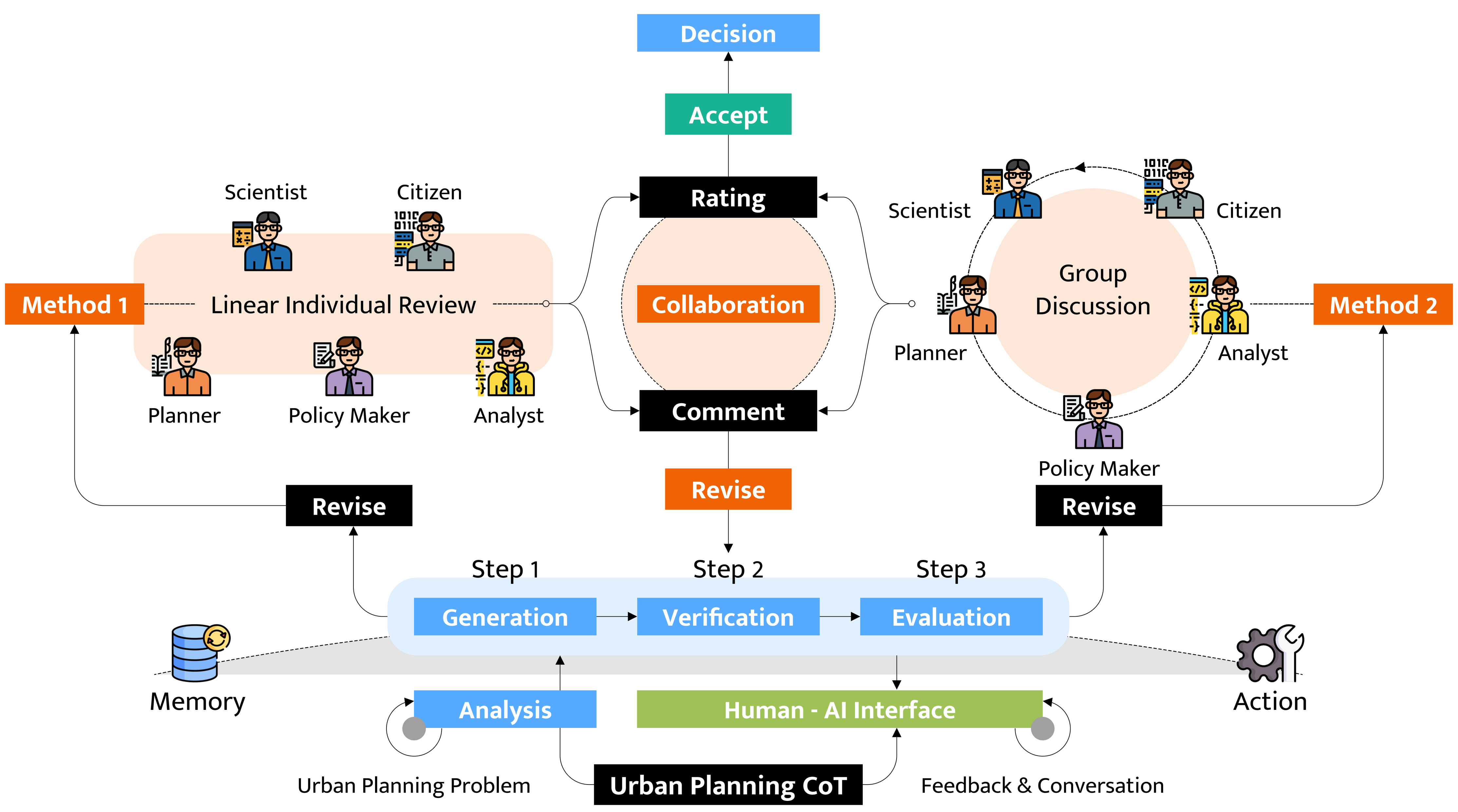
Urban planning AI is shifting from predicting **what will happen (statistical learning) to deciding what should happen—requiring reasoning agents** that can apply norms, satisfy hard constraints, and provide transparent justifications.

Planning Decision Task	Statistical Learning	Reasoning Agents
Value-Based & Principle-Driven		
Equity-driven resource allocation		
Replicate historical allocation	•	•
Apply equity principles	○	•
Challenge unjust patterns	–	•
Novel urban planning context		
Transfer similar patterns	•	•
Reason from first principles	–	•
Competing value prioritisation		
Learn stakeholder preferences	•	•
Deliberate on normative priorities	–	•
Rule-Grounded		
Zoning regulation compliance		
Detect likely violations	•	•
Guarantee zero violations	–	•
Multi-constraint optimization		
Find feasible solutions	•	•
Verify all constraints satisfied	○	•
Contradictory rule resolution		
Flag conflicting requirements	○	•
Resolve using legal reasoning	–	•
Explainable		
Decision justification to public		
Provide recommendations	•	•
Generate readable rationale	○	•
Causal impact chain explanation		
Predict outcomes	•	•
Trace cause-effect reasoning	–	•
"What-if" scenario analysis		
Simulate alternative outcomes	•	•
Explain counterfactual logic	–	•



This work introduces an agentic planning framework and a six-stage reasoning pipeline —**Analysis, Generation, Verification, Evaluation, Collaboration, and Decision**.





By coupling LLM reasoning with **RAG retrieval and tool-based verification** under value constraints, the framework produces inspectable and verifiable planning outcomes.

This **multi-agent collaboration framework** operationalizes the Collaboration component by integrating six logic parts (Analysis, Generation, Verification, Evaluation, Collaboration, Decision) across three cognitive layers through **a unified Human-AI interface**. It supports both **linear individual review and structured group discussion**, enabling stakeholders to iteratively refine proposals via rating, commenting, and revision while preserving human agency in the final decision.

Association for the Advancement of Artificial Intelligence

Yang, S., Li, J., & Biljecki, F. (2025). Reasoning Is All You Need for Urban Planning AI. *AAAI 2026 Workshop on AI for Urban Planning.*