

KATSUDONAgent: An Agent Submitted to the ANAC 2025 SCM League (Standard Track)

Team KATSUDON
Nagoya Institute of Technology
yamadori.kohki@otsukalab.nitech.ac.jp

June 7, 2025

Abstract

This paper presents **KATSUDONAgent**, an autonomous negotiation agent developed for the ANAC 2025 Supply Chain Management League (Standard Track). The agent is designed to handle multi-tier supply chain negotiations through predictive analytics, dynamic pricing strategies, and partner modeling. It balances long-term trust and short-term profitability by adaptively negotiating with multiple partners under uncertain market conditions. This report describes the agent’s design choices, negotiation logic, and future directions.

1 Introduction

The ANA 2025 SCML Standard Track simulates a dynamic, multi-agent supply chain environment. Agents must negotiate contracts to purchase and sell goods over multiple production levels and time steps. **KATSUDONAgent** is designed to operate in such a setting as a middle-level or end-level agent, employing demand forecasting, adaptive concessions, and probabilistic distribution to manage its supply chain interactions.

2 The Design of KATSUDONAgent

2.1 Negotiation Choices

KATSUDONAgent uses past negotiation data to shape its future offers. Specifically:

- **Dynamic Pricing:** Prices are adjusted based on each partner’s past acceptance rates. A higher acceptance rate leads to more assertive pricing, while a lower rate prompts price concessions.
- **Utility-Based Evaluation:** Offers are evaluated by checking whether the quantity meets predicted needs and whether the price falls within acceptable dynamic bounds.
- **Concession Management:** The agent adapts its concession rate according to negotiation progress and failure rates using the formula:

$$concession = t \times (base + 0.3 \times fail_rate)$$

2.2 Concurrent Negotiation

The agent supports concurrent negotiations with multiple suppliers and consumers. For each partner:

- Initial offers are generated via a randomized distribution of the day’s predicted needs.
- The agent accepts offers that best fit its needs within a set threshold and rejects others with counter-proposals for future delivery steps.
- The `counter_all` method implements a heuristic selection to match offers with expected supply/demand levels.

2.3 Risk Management

KATSUDONAgent introduces a **partner scoring system**, tracking the success of negotiations to guide future interactions. Other risk-mitigation features include:

- **Stochastic Need Distribution:** Daily needs are distributed probabilistically to reduce dependency on a single partner.
- **Future Forecasting:** Using exponential smoothing, the agent predicts demand d_t at time t as:

$$d_t = \alpha x_t + (1 - \alpha)d_{t-1}$$

where $\alpha \in (0, 1]$ and x_t is actual demand.

3 Evaluation

During local testing, KATSUDONAgent achieved a high success rate in contract formation, especially in mid-level roles. Key metrics included:

- Average profit over 100 rounds: [Insert number]
- Contract acceptance rate: [Insert %]
- Supply-demand fulfillment rate: [Insert %]

Future benchmarking will be conducted against other competitors using the SCML tournament environment.

4 Lessons and Suggestions

- Rule-based strategies provide stable performance but are limited in adaptability. Integration of learning algorithms such as Q-learning may further improve outcomes.
- Partner-specific behavior models can help discriminate between opportunistic and reliable agents.
- Simple production models may limit scalability; dynamic resource allocation could enhance flexibility.

Conclusions

KATSUDONAgent presents a negotiation framework that combines probabilistic planning, partner modeling, and dynamic concessions to manage complex supply chain negotiations. While the current implementation relies on heuristics, its modularity allows future integration of learning-based strategies and deeper behavioral models. These extensions will be critical for success in highly competitive environments like the ANAC SCML.