What is new in SCML 2021?

SCML Organizing Committee

May 15, 2021

NEC-AIST
AI Cooperative Research Laboratory
Motivation

Why SCML?

- The raison d’être for SCML is still the same: to move automated negotiation further toward the real world.
- The guiding principles in our design are:
  - Simple enough but not too simple.
  - Continuity matters.

Main Changes

- More information about the market is made available to agents.
- Changes in the evaluation criterion for Standard and Collusion tracks.
- A new track emphasizing concurrent negotiation and learning more (OneShot).
Outline

Track Philosophies

Changes in Existing Tracks
   More Information
   Evaluation Changes
   Behavioral Changes

A New Track
   Difference between OneShot and other tracks
Track Philosophies

OneShot Track

- Focuses on solving the problem of **concurrent negotiation** with a utility function that calculates day profit exactly for the complete set of agreements (and independent of the future or the past).
- Provides a simpler environment (compared with other tracks) for learning how to customize an agent’s negotiation behavior for specific partners and for general market conditions over time.

Standard Track

- Focuses on solving **interconnected planning and negotiation** in a realistic(ish) dynamically evolving environment.

Collusion Track

- Focuses on **negotiation in the wild** with the goal of finding possible ways to subvert an automated negotiation market through collusion.
  - Consider it a form of ethical hacking.
Market Information

Trading prices

- Trading prices representing a weighted running average of different product prices.
- Used internally but not available to agents in 2020.
- It is now available to the agent through the AWI in all tracks.

Exogenous Contract Summary

- The total quantity and average prices of all exogenous contracts are now available through the AWI.
  - Exogenous contracts for individual agents is still private information.
Evaluation Changes

Consolidated Financial Statements

- This change affects the **collusion** track only.
- In 2020, the final score was the median score of all factories controlled by the agent.
- In 2021, the final score will be the consolidated truncated mean:
  - Scores of all factories controlled by the agent type **in a given simulation** are summed up giving one score per agent type per simulation
  - The truncated mean is calculated using these consolidated scores.
- This ensures that having one of your factories lose to the others will not affect your final scores.

Finalist rule

- Finalists for the **collusion** track must have a reported nontrivial collusion strategy.

Score calculation

- In 2021, the **truncated mean** will be used instead of the median for calculating final scores of agent types (i.e. outliers will be removed per agent type and the mean of the remaining scores will be the final score).
Agent Behavior

New and modified Built-in components

Given the availability of trading prices and exogenous contract summary in 2021, we provide new agents and components that uses them to improve their behavior:

▶ **MarketAwareTradePredictionStrategy**: Uses the exogenous contract summary to provide a better estimate of trade.

▶ **KeepOnlyGoodPrices**: Uses the trading prices to sign only contracts that have acceptably good prices. By default, this means buying at no more than 50% above the trading price and selling no more than half that price. You can control these limits.

▶ **NegotiationStrategy**: Negotiation strategies now adjust the negotiation agenda to the trading price\(^1\).

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\(^1\)If run in an SCML2020World with no published trading prices, it will use catalog prices
Agent Behavior

New built-in agents

New agents are provided that use the new components utilizing market information. They all start with *MarketAware*

- **MarketAwareDecentralizingAgent**: Based on DecentralizingAgent
- **MarketAwareIndDecentralizingAgent**: Based on IndDecentralizingAgent
- **MarketAwareRangeAgent**: Based on RangeAgent
- **MarketAwareBuyCheapSellExpensive**: Based on BuyCheapSellExpensive
- **MarketAwareIndNegotiationsAgents**: Based on IndNegotiationsAgents
- ...  

Behavior of old built-in agents

You may see some changes in the behavior of old built-in agents because they use tighter negotiation issue spaces by default.
SCML-OneShot Track

Main Idea

- Same as SCML-OneShot but repeated.
- Main difference from SCML2020:
  - No need to think about future negotiations.
  - Every day you get a fresh set of exogenous contracts.
    - Think of it as yearly instead of daily negotiation.

More Information

- Everything: https://scml.cs.borwn.edu
- Game Description: http://www.yasserm.com/scml/scml2021oneshot.pdf
Inventory

Inventory Persistence

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Products never perish</td>
<td>All products perish at the end of each day.</td>
</tr>
</tbody>
</table>

Inventory Valuation in Score Calculation

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inventory is valued at a fraction of the trading price at the end.</td>
<td>Inventory is not valued at all (because it perishes)</td>
</tr>
</tbody>
</table>

Implications

- Never buy more than what you can produce and sell immediately.
- Future market conditions do not matter for today’s profit.
### Market and Production Graph

#### Production Graph

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can have more than one intermediate product</td>
<td>Always have exactly one intermediate product</td>
</tr>
</tbody>
</table>

#### Implications

- No need to consider the case when your agent has no exogenous contracts.
- It is recommended **for future proofing** to either work in the middle of the production chain or fail gracefully.

### Public Information

All tracks in 2021 have public market information that was not available in 2020:

- Trading prices
- Exogenous contracts summary.
## Long Term Planning

### Trading Strategy

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Needed because market conditions in the future affect the value of buying/selling today</td>
<td>Not needed because market conditions in the future cannot affect the value of buying/selling today</td>
</tr>
</tbody>
</table>

### Implications

- You cannot hope to get high profits by devising agendas for your benefit.
- You need not to think about whom to negotiate with (even though you still can decide to end negotiations early with some partners).
Negotiation

Negotiation Agenda

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decided by the agent</td>
<td>Decided by the simulator in a transparent manner.</td>
</tr>
</tbody>
</table>

Implications

- You cannot hope to get high profits by devising agendas for your benefit.
- You need not to think about whom to negotiate with (even though you still can decide to end negotiations early with some partners).
## Negotiation Agenda

### Delivery Time

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negotiable</td>
<td>Not-negotiable (always today)</td>
</tr>
</tbody>
</table>

### Quantity

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>May be good to buy/sell above your n. lines</td>
<td>It is never good to buy/sell above your n. lines</td>
</tr>
</tbody>
</table>

### Implications

- Simpler ufuns and smaller search spaces.
Utility Functions

Exactness of UFuns

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>It is not possible to define a utility function for a set of concurrent negotiations that exactly matches the effect of outcomes on your score</td>
<td></td>
</tr>
<tr>
<td>▶ An exact ufun is defined for the complete set of concurrent negotiations but not for any subset of them.</td>
<td></td>
</tr>
<tr>
<td>▶ ufun of an agent in different days are similar.</td>
<td></td>
</tr>
</tbody>
</table>

Implications

▶ You may still need to define a ufun for each negotiation independently.
▶ The relative stability (yet with some variability) of each partner’s ufun at different days, simplifies learning how to negotiate with them over the course of the simulation.
## Exogenous Contract Distribution

### Consistency of Exogenous Contracts

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exogenous contracts are distributed completely randomly in different days. For example if we have two agents A and B and the total quantity in exogenous contracts is 10, either can get 0, 10 or anything in between</td>
<td>Agents will tend to have relatively high or low quantities in their exogenous contracts consistently.</td>
</tr>
</tbody>
</table>

### Implications

- The ufuns of agents are not completely independent in all days opening the way to learn them over time during the simulation.
Contract Signing

**Signing**

<table>
<thead>
<tr>
<th>Standard/Collusion</th>
<th>OneShot</th>
</tr>
</thead>
<tbody>
<tr>
<td>All agents have the chance to sign/not sign agreements into contracts.</td>
<td>Agreements are automatically signed into contracts</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Implications</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>▶ Once you or your partner ACCEPT an offer, it <em>immediately</em> becomes binding for both of you.</td>
</tr>
<tr>
<td>▶ You cannot get redundant agreements and sign a subset of them into contracts.</td>
</tr>
</tbody>
</table>