Contribution ID: **40**                                            Type: **Apresentação regular**

# Balancing Fulfillment Costs with Vendor Goals: Optimizing Order Allocation in Online Marketplaces with Reinforcement Learning

Online marketplaces provide a platform that connects suppliers with customers, allowing vendors to sell their products to a broader audience. To streamline customer experience, some marketplaces allocate a set of fulfillment vendors and stockpoints at the moment a customer is placing an order in the platform. This order allocation decision impacts not only fulfillment costs and customer satisfaction but also sales volume received by suppliers, directly impacting supplier retention on the platform. We introduce the Multi-Item Order Fulfillment Problem in Online Marketplaces, which considers suppliers' perspective by incorporating sales targets over a selling season.

Reinforcement Learning is applied to the problem by means of the Deep Controlled Learning algorithm, which hybridizes Approximate Policy Iteration with Supervised Learning. As a benchmark, two families of solution methods are considered: various myopic rule-based policies, popular in practice, and two randomized policies with attractive asymptotic properties.

We compare these policies on real-world-based instances tailored based on past interactions with an online marketplace. We find that our approach is superior when demand per item is relatively low, while achieving balanced outcomes on the multiple perspectives (cost, supplier and customer satisfaction).

**Author:**   CASTRO, Sérgio (INESC TEC, FEUP)

**Co-authors:**   Dr ALMADA-LOBO, Bernardo (INESC TEC, FEUP);   Prof. FIGUEIRA, Gonçalo (INESC TEC, FEUP);   Dr JAARSVELD, Willem van (TUE)

**Presenter:**   CASTRO, Sérgio (INESC TEC, FEUP)

**Session Classification:**   Session 3.3 - Retail and sales