

Dynamic Order Sourcing Optimization for Online Retail with Deep Reinforcement Learning

Master Thesis

by

Marcus Ritter

Matriculation number: 11004061

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Reviewers

Professor Barbara Sprick

Doctor Owen Hickey

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Thesis Advisory Committee

..... (Internal Supervisor)
Professor Barbara Sprick
SRH University Heidelberg

..... (Internal Supervisor)
Professor Gerd Moeckel
SRH University Heidelberg

..... (External Advisor)
Doctor Owen Hickey
SAP

Affidavit

Herewith I declare:

- that I have composed the chapters for the Master Thesis for which I am named as the author independently,
- that I did not use any other sources and additives than the ones specified,
- that I did not submit this work at any other examination procedure.

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Abstract

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Chapter 1

Introduction

TODO:

1. Hinführung zum Thema / Praktische, Wissenschaftliche Motivation
2. Problemstellung
3. Eingrenzung der Problemstellung / was ist Teil der Arbeit und was nicht
4. Zielsetzung
5. Methoden und Vorgehen / Welche Methodik wird eingesetzt um die Ziele zu erreichen
6. ML einführen
7. Beiträge der Arbeit
8. Wie die Lösung evaluiert wird
9. Wie man zur Lösung kommt (Inhalt der einzelnen Chapter)

Today's retail market is quickly changing and holds many challenges for the retailers competing in this business (it). E-commerce or online retailing became absolutely indispensable for the majority of the companies. Accordingly you can see that the share of the sales volume on online retails is increasing every year.

heavily characterized by e-commerce and online retailers.

Dispite the clascal pure online retailers like Amazon, also traditional retailers (Brick and Mortar retailers) are making their step to e-commerce and start selling their products online.

Dynamic Order Sourcing Optimization for Online Retail with Deep Reinforcement Learning

Like with the change in the dotcom era from normal to online retail now the shift goes to omni-channel retailing. This is the new trend in the market.

In the last years many online retailers have come of age. The retail sector is more and more characterized by the big online retailers e.g. Amazon. The retail market is changing.

Today's retail marketplace is competitive and ever-changing. There are several new challenges in the today's market.

(Piotrowicz and Cuthbertson, 2014)

The increased deployment of new technologies such as smart mobile devices and social networks and the growing importance of in-store technological solutions create new opportunities and challenges for retailers. As the line between online and physical channels is blurred, a new approach to channel integration is emerging—the omnichannel, which aims to deliver a seamless customer experience regardless of the channel. This introduction presents the results of focus group discussions on the role of information technology in retail, new business models, and the future role of traditional stores as e-commerce advances. Key issues that emerged from the discussion include the need for channel integration, the impact of mobile technologies, the growing role of social media, the changing role of physical brick-and-mortar stores, the need to respond to diverse customer requirements, the balance between personalization and privacy, and, finally, supply chain redesign. The four papers in this Special Issue explore these themes further.

(Verhoef et al., 2015)

The world of retailing has changed dramatically in the past decade. The advent of the online channel and new additional digital channels such as mobile channels and social media have changed retail business models, the execution of the retail mix, and shopper behavior. Whereas multi-channel was in vogue in the last decade in retailing, we now observe a move to so-called omni-channel retailing. Omni-channel retailing is taking a broader perspective on channels and how shoppers are influenced and move through channels in their search and buying process. We discuss this development conceptually and subsequently discuss existing research in this multi-channel retailing. We also introduce the articles in this special issue on multi-channel retailing and position these articles in the new omni-channel movement. We end with putting forward a research agenda to further guide future research in this area.

Chapter 2

Chapter2

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$$Q(s_t, a_t) \leftarrow (1 - \alpha) \cdot Q(s_t, a_t) + \alpha \cdot \left(r_t + \gamma \cdot \max_a Q(s_{t+1}, a) \right) \quad (2.1)$$

As shown in Equation (2.1) the Q-Learning features a quite fancy formula. Though the equation is very useful solving logistic problems like the sourcing optimization. At the same time Figure (2.1) shows a very nice picture of Mars (Mnih et al., 2015, p.150ff). Now we will take a look at some listings and available options.

```
1 'Choose maximum q value action and validate it'
2 def choose_action_maxq(self, S):
3     # choose an action according to the max q value
4     action_names = []
5     S = S.observation
6     S_np = np.array(S)
7     S = S_np[np.newaxis, :]
8     action_values = self.sess.run(self.q_eval, feed_dict={self.s: S})
9     for i in range(len(self.ACTIONS_INDEX)):
10         temp = self.ACTIONS_INDEX[i][0]
11         temp2 = action_values[0][temp]
12         action_names.append([self.ACTIONS_INDEX[i][0], self.
ACTIONS_INDEX[i][1], temp2])
13     action_names.sort(key=self.getListKey, reverse=True)
14     # check if the actions is valid, if not choose the next best one
15     for j in range(len(action_names)):
16         action = action_names[j][1]
17         action_id = action_names[j][0]
18         valid_action, out_of_stock = self.validate_action(action)
19         if(valid_action == True):
```

```
20         break
21     return action_id
```

Listing 2.1: Some Caption for the Listing, Source: (Mnih et al., 2015).

Above you can see the Listing (2.1) with a nice formatting that fits the Python language.

2.1 section1

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2.1.1 subsection1

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2.1.2 subsection2

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2.2 section2

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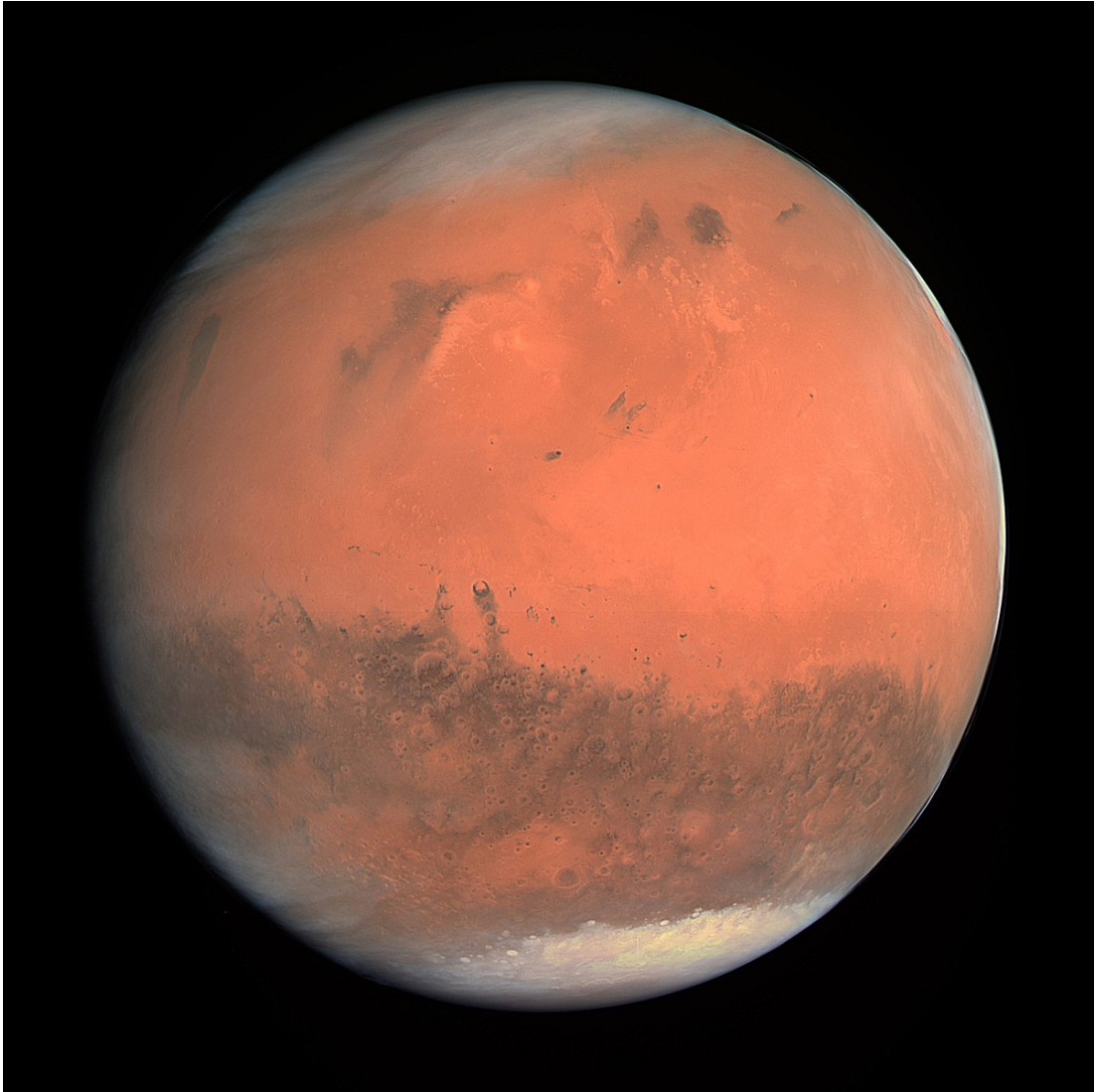


Figure 2.1: Caption Text
Source: ?.

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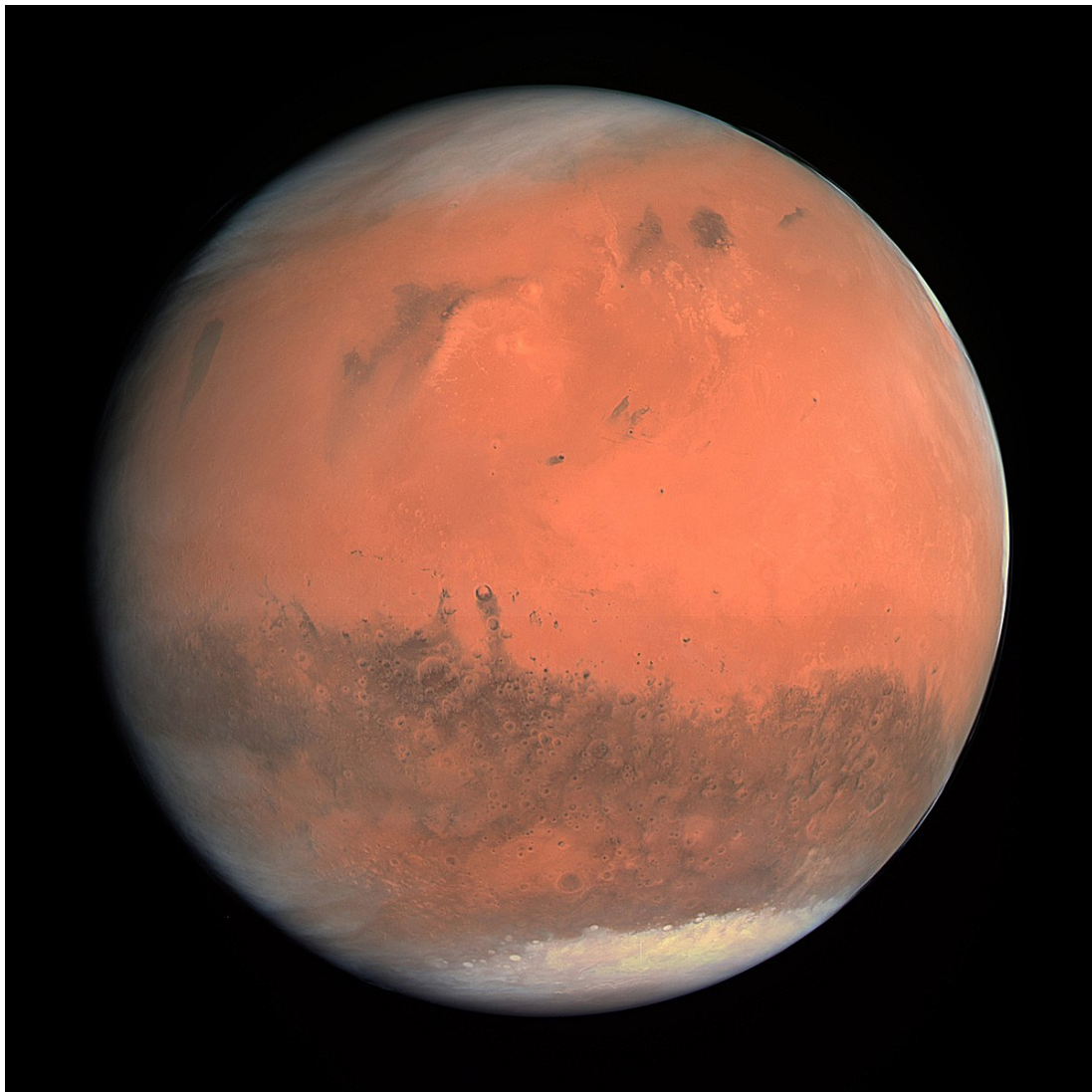


Figure 2.2: Caption Text2 Source: (Silver et al., 2016).

Table 2.1: Even better looking table using booktabs

Dental measurement	Species I		Species II	
	mean	SD	mean	SD
I1MD	6.23	0.91	5.2	0.7
I1LL	7.48	0.56	8.7	0.71
I2MD	3.99	0.63	4.22	0.54
I2LL	6.81	0.02	6.66	0.01
CMD	13.47	0.09	10.55	0.05
CBL	11.88	0.05	13.11	0.04

Chapter 3

Chapter3

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3.1 section1

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3.1.1 subsection1

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3.1.2 subsection2

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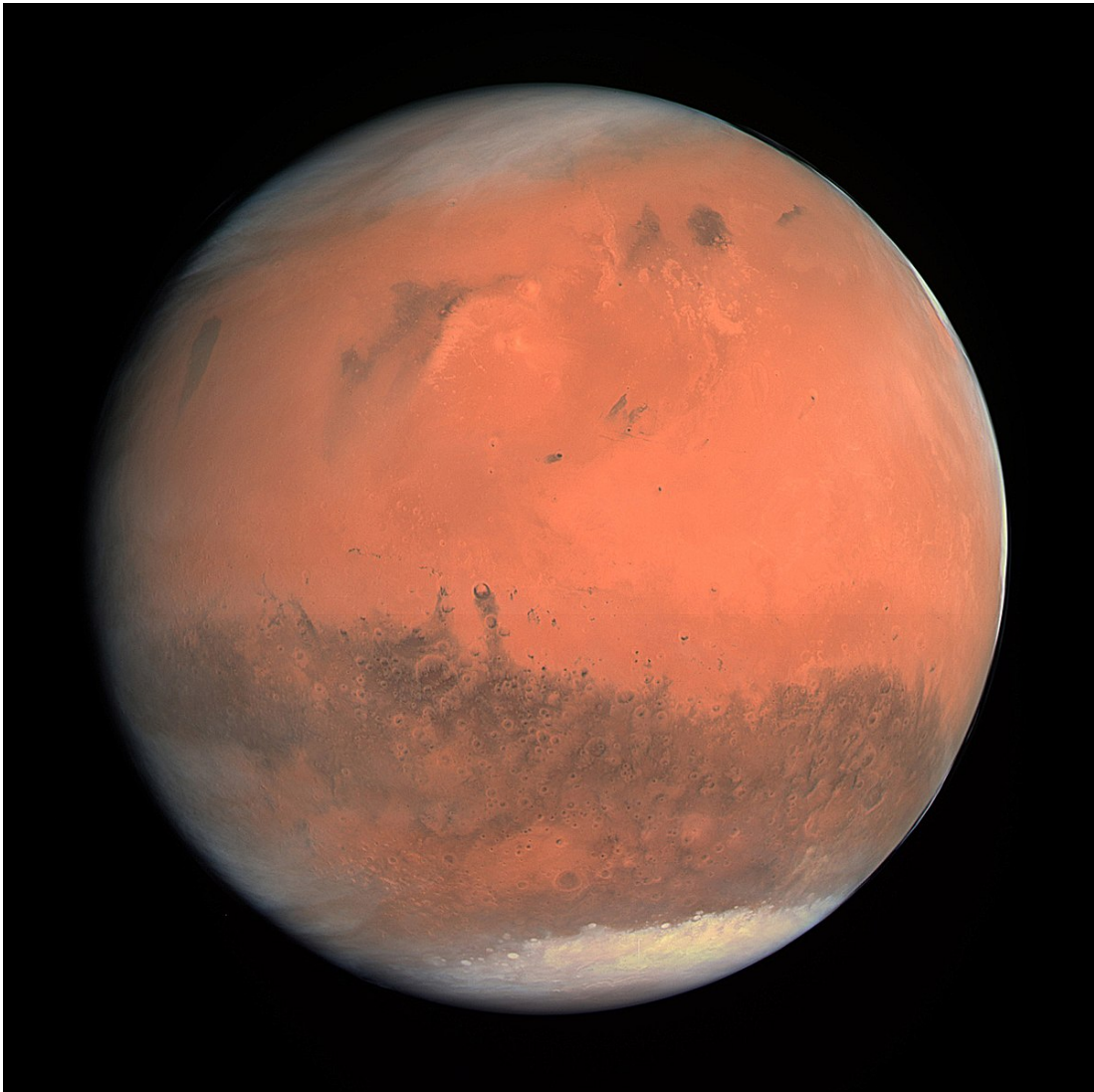


Figure 3.1: Caption Text
Source: Some Source .

Appendix A

Appendix

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A.1 Section1

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A.2 Section2

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A.2.1 Subsection1

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A.2.2 Subsection2

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A.2.3 Subsection3

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