1 Exploring exponential smoothing

June 13, 2019

```
In [21]: import os
         os.getcwd()

Out[21]: 'C:\\Users\\Stefan\\LRZ Sync+Share\\Masterarbeit-Klein\\Code\\Results'
```

1 Usage of exponential smoothing in API

1.1 Ziel

Hier möchte ich zeigen, dass exponential smoothing wie in Koch, 3.3. Update of parameters erwähnt, im Wesentlichen eine Durchschnittsbildung ist.

1.2 Vorgehensweise

Den relevanten Code habe ich in der Datei "1 E_API_lin_single_leg.py" gespeichert. Hier gibt es in der Methode *update_parameters* zwei unterschiedliche return statements, einmal ohne und einmal mit exponential smoothing.

Die Ergebnisse der beiden Durchläufe habe ich gespeichert: * 1-no-exponential-smoothing--smallTest-False-API-lin-190612-1049: ohne exponential smoothing * 1-exponential-smoothing--smallTest-False-API-lin-190612-1055: mit exponential smoothing

Zu diesem Zeitpunkt habe ich den Algorithmus zur Approximate policy iteration (Koch Kapitel 3) für den linearen Fall (nicht piecewise) und ohne exploration vs. exploitation dilemma implementiert.

1.3 verwendete Daten

Als Beispieldatensatz wurde der folgende verwendet. data_by_name["smallTest"] = {}

data_by_name["smallTest"]["products"] = np.arange(4) # n data_by_name["smallTest"]["revenues"] = np.array([1000, 800, 600, 400])

data_by_name["smallTest"]["times"] = np.arange(10) # T

data_by_name["smallTest"]["customer_segments"] = np.arange(1) # L data_by_name["smallTest"]["arrival_probabilities"] = np.array([0.5]) data_by_name["smallTest"]["preference_weights"] = np.array([[0.4, 0.8, 1.2, 1.6]])

data_by_name["smallTest"]["var_no_purchase_preferences"] = np.array([[1]]) data_by_name["smallTest"]["preference_no_purchase"] = np.array(data_by_name["smallTest"]["var_no_purchase_preferences"][0])

data_by_name["smallTest"]["resources"] = np.arange(1) # m

data_by_name["smallTest"]["var_capacities"] = np.array([[4]]) data_by_name["smallTest"]["capacities"] = data_by_name["smallTest"]["var_capacities"][0]

capacity demand matrix A (rows: resources, cols: products) # a_ij = 1 if resource i is used by product j data_by_name["smallTest"]["A"] = np.array([[1, 1, 1, 1]])

Und für die Policy Iteration: K = 10 I = 100

```
In [11]: import pandas as pd
         import numpy as np

         import pickle
         import copy

In [17]: with open(r"C:\Users\Stefan\LRZ Sync+Share\Masterarbeit-Klein\Code\Results\1-no-expone
             thetas_no_es = pickle.load(f)
         with open(r"C:\Users\Stefan\LRZ Sync+Share\Masterarbeit-Klein\Code\Results\1-no-expone
             pis_no_es = pickle.load(f)

         thetas_calculated = copy.deepcopy(thetas_no_es)
         for k in np.arange(len(thetas_no_es)-1)+1:
             thetas_calculated[k] = np.average(thetas_no_es[1:(k+1)], axis=0)

         pis_calculated = copy.deepcopy(pis_no_es)
         for k in np.arange(len(pis_no_es)-1)+1:
             pis_calculated[k] = np.average(pis_no_es[1:(k+1)], axis=0)

In [9]: with open(r"C:\Users\Stefan\LRZ Sync+Share\Masterarbeit-Klein\Code\Results\1-exponentia
            thetas_es = pickle.load(f)
        with open(r"C:\Users\Stefan\LRZ Sync+Share\Masterarbeit-Klein\Code\Results\1-exponentia
            pis_es = pickle.load(f)

In [14]: thetas_calculated - thetas_es

Out[14]: array([[[ 0.00000000e+00],
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In [18]: pis_calculated - pis_es
```

```
Out[18]: array([[[ 0.00000000e+00],
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```