Assignment 2 – Theoretical part

Udi Rot 205653025, Noa Koren 305169344, Yoni Hornstein 205485600

# N-gram language model

* 1. **ngram\_model.py**
  2. grid search results:

**(lambda1, lambda2)=perplexity**

**(0.0, 0.0)=214.0634 (unigram)**

**(0.0, 0.05)=154.6648**

**(0.0, 0.1)=134.0129**

**(0.0, 0.15)=120.949**

**(0.0, 0.2)=111.5200**

**(0.0, 0.25)=104.2478**

**(0.0, 0.30)=98.4113**

**(0.0, 0.35)=93.6023**

**(0.0, 0.4)=89.5685**

**(0.0, 0.45)=86.1443**

**(0.0, 0.5)=83.2171**

**(0.0, 0.55)=80.7089**

**(0.0, 0.6)=78.5669**

**(0.0, 0.65)=76.757**

**(0.0, 0.7)=75.266**

**(0.0, 0.75)=74.1002**

**(0.0, 0.8)=73.296**

**(0.0, 0.85)=72.953**

**(0.0, 0.9)=73.3245**

**(0.0, 0.95)=75.2745**

**(0.0, 1) = inf**

(0.05, 0.0)=137.789

(0.05, 0.05)=117.813

(0.05, 0.1)=107.1450

(0.05, 0.15)=99.5089

(0.05, 0.2)=93.5952

(0.05, 0.25)=88.8184

(0.05, 0.30)=84.857

(0.05, 0.35)=81.5165

(0.05, 0.4)=78.6671

(0.05, 0.45)=76.2225

(0.05, 0.5)=74.1231

(0.05, 0.55)=72.3287

(0.05, 0.6)=70.8155

(0.05, 0.65)=69.5749

(0.05, 0.7)=68.6171

(0.05, 0.75)=67.9807

(0.05, 0.8)=67.7596

(0.05, 0.85)=68.1916

(0.05, 0.9)=70.0839

(0.05,0.95)=inf

(0.1, 0.0)=119.3163

(0.1, 0.05)=104.1723

(0.1, 0.1)=96.0380

(0.1, 0.15)=90.0856

(0.1, 0.2)=85.3976

(0.1, 0.25)=81.5638

(0.1, 0.30)=78.357

(0.1, 0.35)=75.6380

(0.1, 0.4)=73.3145

(0.1, 0.45)=71.3254

(0.1, 0.5)=69.6302

(0.1, 0.55)=68.204

(0.1, 0.6)=67.0406

(0.1, 0.65)=66.1474

(0.1, 0.7)=65.562

(0.1, 0.75)=65.3766

(0.1, 0.8)=65.8199

(0.1, 0.85)=67.672

(0.1,0.9)=inf

(0.15, 0.0)=108.6486

(0.15, 0.05)=95.7047

(0.15, 0.1)=88.8831

(0.15, 0.15)=83.8686

(0.15, 0.2)=79.8991

(0.15, 0.25)=76.6410

(0.15, 0.30)=73.9114

(0.15, 0.35)=71.59

(0.15, 0.4)=69.6306

(0.15, 0.45)=67.9613

(0.15, 0.5)=66.5630

(0.15, 0.55)=65.4249

(0.15, 0.6)=64.5546

(0.15, 0.65)=63.9877

(0.15, 0.7)=63.8124

(0.15, 0.75)=64.2527

(0.15, 0.8)=66.0707

(0.15,0.85)=inf

(0.2, 0.0)=101.4690

(0.2, 0.05)=89.767

(0.2, 0.1)=83.7575

(0.2, 0.15)=79.3518

(0.2, 0.2)=75.866

(0.2, 0.25)=73.0091

(0.2, 0.30)=70.6219

(0.2, 0.35)=68.6105

(0.2, 0.4)=66.9161

(0.2, 0.45)=65.5040

(0.2, 0.5)=64.358

(0.2, 0.55)=63.4843

(0.2, 0.6)=62.91416

(0.2, 0.65)=62.73336

(0.2, 0.7)=63.16139

(0.2, 0.75)=64.9471

(0.2,0.8)=inf

(0.25, 0.0)=96.30

(0.25, 0.05)=85.3578

(0.25, 0.1)=79.8955

(0.25, 0.15)=75.9184

(0.25, 0.2)=72.7860

(0.25, 0.25)=70.2301

(0.25, 0.30)=68.1092

(0.25, 0.35)=66.3411

(0.25, 0.4)=64.8778

(0.25, 0.45)=63.69584

(0.25, 0.5)=62.7946

(0.25, 0.55)=62.2030

(0.25, 0.6)=62.0034

(0.25, 0.65)=62.4111

(0.25, 0.7)=64.1655

(0.25,0.75)=inf

(0.30, 0.0)=92.4620

(0.30, 0.05)=81.9853

(0.30, 0.1)=76.9109

(0.30, 0.15)=73.2519

(0.30, 0.2)=70.3911

(0.30, 0.25)=68.0759

(0.30, 0.30)=66.1763

(0.30, 0.35)=64.6202

(0.30, 0.4)=63.370

(0.30, 0.45)=62.4186

(0.30, 0.5)=61.78768

(0.30, 0.55)=61.55596

(0.30, 0.6)=61.93502

(0.30, 0.65)=63.6573

(0.30

(0.35, 0.0)=89.5897

(0.35, 0.05)=79.3766

(0.35, 0.1)=74.5845

(0.35, 0.15)=71.1706

(0.35, 0.2)=68.528

(0.35, 0.25)=66.4169

(0.35, 0.30)=64.7140

(0.35, 0.35)=63.3586

(0.35, 0.4)=62.32784

(0.35, 0.45)=61.6367

(0.35, 0.5)=61.3579

(0.35, 0.55)=61.6986

(0.35, 0.6)=63.3864

(0.35, 0.65)=inf

(0.4, 0.0)=87.4742

(0.4, 0.05)=77.3685

(0.4, 0.1)=72.7839

(0.4, 0.15)=69.5

(0.4, 0.2)=67.1087

(0.4, 0.25)=65.1791

(0.4, 0.30)=63.6652

(0.4, 0.35)=62.51916

(0.4, 0.4)=61.7418

(0.4, 0.45)=61.39730

(0.4, 0.5)=61.68749

(0.4, 0.55)=63.3364

(0.4,0.6)=inf

(0.45, 0.0)=85.9927

(0.45, 0.05)=75.8610

(0.45, 0.1)=71.4281

(0.45, 0.15)=68.3703

(0.45, 0.2)=66.0797

(0.45, 0.25)=64.3267

(0.45, 0.30)=63.0129

(0.45, 0.35)=62.11356

(0.45, 0.4)=61.6784

(0.45, 0.45)=61.90180

(0.45, 0.5)=63.5047

(0.45,0.55)=inf

(0.5, 0.0)=85.0788

(0.5, 0.05)=74.7956

(0.5, 0.1)=70.4713

(0.5, 0.15)=67.5527

(0.5, 0.2)=65.422

(0.5, 0.25)=63.8

(0.5, 0.30)=62.7835

(0.5, 0.35)=62.2225

(0.5, 0.4)=62.3559

(0.5, 0.45)=63.9013

(0.5,0.5)=inf

(0.55, 0.0)=84.708

(0.55, 0.05)=74.1442

(0.55, 0.1)=69.8952

(0.55, 0.15)=67.106

(0.55, 0.2)=65.147

(0.55, 0.25)=63.8120

(0.55, 0.30)=63.0712

(0.55, 0.35)=63.0803

(0.55, 0.4)=64.550

(0.55, 0.45)=inf

(0.6, 0.0)=84.8972

(0.6, 0.05)=73.9068

(0.6, 0.1)=69.7086

(0.6, 0.15)=67.0558x

(0.6, 0.2)=65.307

(0.6, 0.25)=64.29

(0.6, 0.30)=64.1284

(0.6, 0.35)=65.4937

(0.6, 0.4)=inf

(0.65, 0.0)=85.7052

(0.65, 0.05)=74.1135

(0.65, 0.1)=69.9531

(0.65, 0.15)=67.4694

(0.65, 0.2)=66.0280

(0.65, 0.25)=65.588

(0.65, 0.30)=66.8003

(0.65, 0.35)=inf

(0.7, 0.0)=87.2562

(0.7, 0.05)=74.8362

(0.7, 0.1)=70.7212

(0.7, 0.15)=68.49

(0.7, 0.2)=67.6144

(0.7, 0.25)=68.5832

(0.7,0.3)=inf

(0.75, 0.0)=89.7780

(0.75, 0.05)=76.2153

(0.75, 0.1)=72.2031

(0.75, 0.15)=70.490

(0.75, 0.2)=71.0384

(0.75, 0.25)=inf

(0.8, 0.0)=93.700

(0.8, 0.05)=78.5281

(0.8, 0.1)=74.8290

(0.8, 0.15)=74.5372

(0.8, 0.2)=inf

(0.85, 0.0)=99.910

(0.85, 0.05)=82.3917

(0.85, 0.1)=79.9063

(0.85, 0.15)=inf

(0.9, 0.0)=110.6223

(0.9, 0.05)=89.6528

(0.9, 0.1)=inf

(0.95, 0.0)=133.987

(0.95, 0.05)=inf

(1.0, 0)=inf

It can be seen that the min perplexity received from this algorithm is: **61.35794**, got for (lambda1, lambda2) = (0.35, 0.5)