Problem 1 (Markov Chains)

Part 1

Use w_t to rank the teams by sorting in decreasing value according to this vector. List the top 20 teams and their corresponding values in w_t for $t = 10, 100, 200, 1000$.

Team	Value
UW-Whitewater	0.0153227778802
MountUnion	0.0130742707022
ColoradoSt-Pueblo	0.010261008372
OhioState	0.00900979434094
Linfield	0.00878443452911
MinnSt-Mankato	0.00821200630016
Wartburg	0.00801802217138
Wesley	0.00748839125774
SouthernOregon	0.00744005399386
Oregon	0.0071542337095
Alabama	0.00714054428404
NorthDakotaSt	0.00669991126614
TCU	0.00645504966615
MaryHardin-Baylor	0.00597635138467
FloridaSt	0.005944344405
Hobart	0.00590135339447
JohnCarroll	0.00586308936461
MarianIN	0.00580349073704
Widener	0.00578632328033
Concord	0.00568551087686

Table 1: Teams and values for t=10

Team	Value
UW-Whitewater	0.0292759841104
OhioState	0.0276631131678
Oregon	0.0227262816528
Alabama	0.0186769498344
TCU	0.0183015022646
MountUnion	0.0168714020987
FloridaSt	0.0146308745614
MichiganSt	0.0130287913339
ColoradoSt-Pueblo	0.012999116209
SouthernOregon	0.0124931074259
Baylor	0.0122206343863
GeorgiaTech	0.0118210801366
Wartburg	0.0106811487305
UCLA	0.0106652138505
Mississippi	0.0103657540733
CarrollMT	0.0102792997905
Georgia	0.0101168632625
Arizona	0.00994307528077
ArizonaSt	0.00912162056362
MississippiSt	0.0090671268847

Table 2: Teams and values for t=100

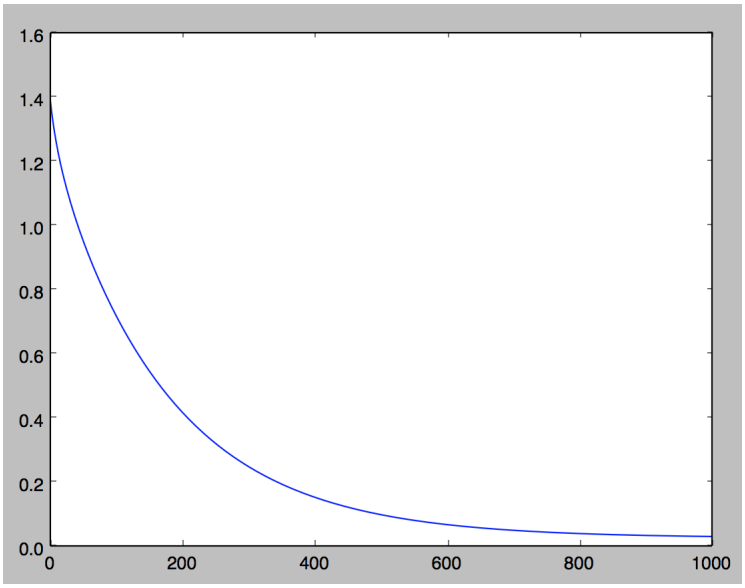
Team	Value
OhioState	0.0363316355665
Oregon	0.0298306907239
Alabama	0.0243530549619
TCU	0.0240409405987
FloridaSt	0.0191361282377
UW-Whitewater	0.0182123273704
MichiganSt	0.0169569400722
Baylor	0.0160206375044
GeorgiaTech	0.0154243558734
UCLA	0.0139841818668
Mississippi	0.0134738824039
Georgia	0.0130837202891
Arizona	0.0130263839136
ArizonaSt	0.0119023046243
MississippiSt	0.0117965208801
Missouri	0.0111035953543
Clemson	0.0104986782094
SouthernCal	0.0104490838612
Wisconsin	0.0104461197528
Auburn	0.0102624439426

Table 3: Teams and values for t=200

Team	Value
OhioState	0.0473971919558
Oregon	0.0387971225418
Alabama	0.0316777096693
TCU	0.0313994942541
FloridaSt	0.0249885243121
MichiganSt	0.0219768459681
Baylor	0.0208884123061
GeorgiaTech	0.0201149670139
UCLA	0.0181695841427
Mississippi	0.0174792512804
Georgia	0.0169436471106
Arizona	0.0168959738481
ArizonaSt	0.0154034382393
MississippiSt	0.0153259619966
Missouri	0.014157805926
Clemson	0.0136641097675
SouthernCal	0.013544901098
Wisconsin	0.0133728015051
Auburn	0.0133087636274
Utah	0.0129390741129

Table 4: Teams and values for t=1000

Part 2

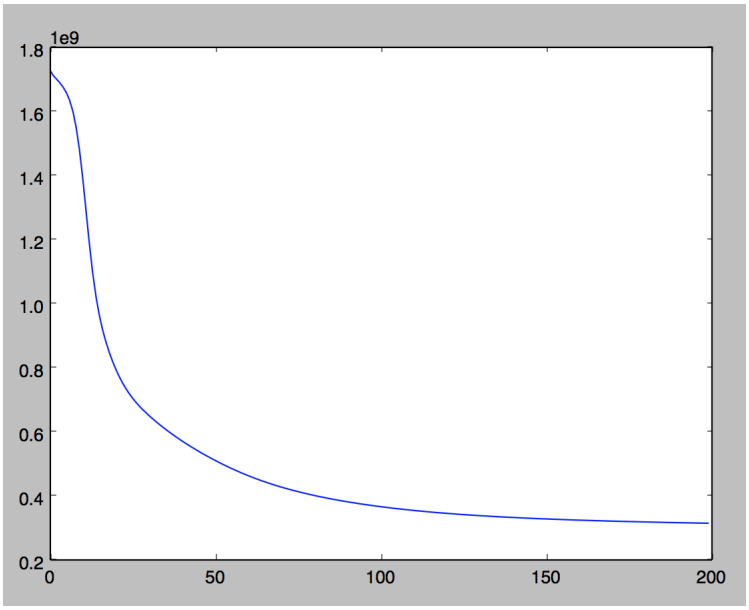


$||w_t - u_{1_{norm}}||_1$ as a function of t

At t_1000, $||w_t - u_{1_{norm}}||_1 = 0.031538506048135205$

Problem 2 (Nonnegative Matrix Factorization)

Part 1, faces



Objective function for the Euclidean penalty, as function of iteration

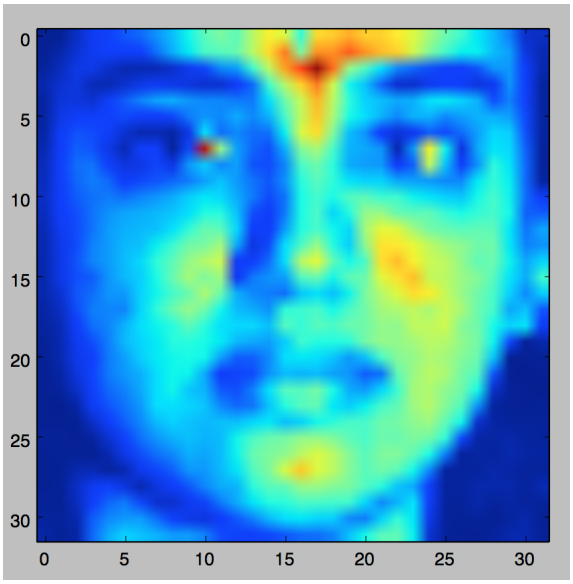
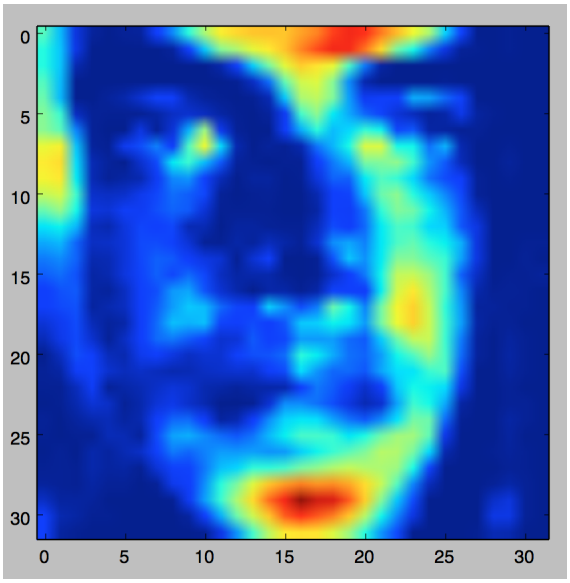


Image 1



W_{19}, corresponding to biggest value in H for image 1.

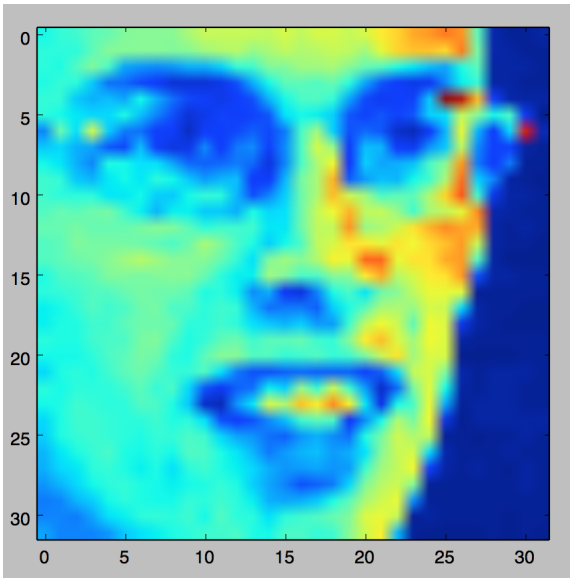
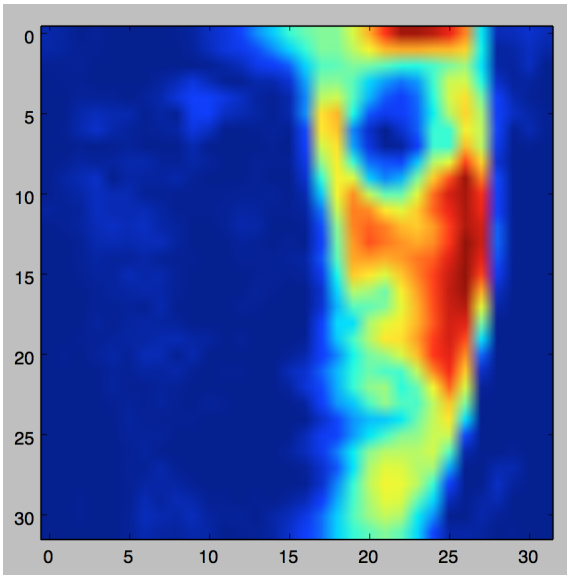


Image 20



W_{21}, corresponding to biggest value in H for image 20.

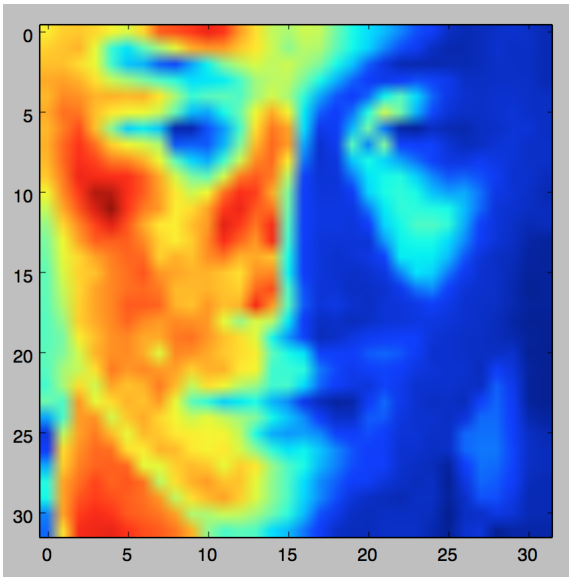
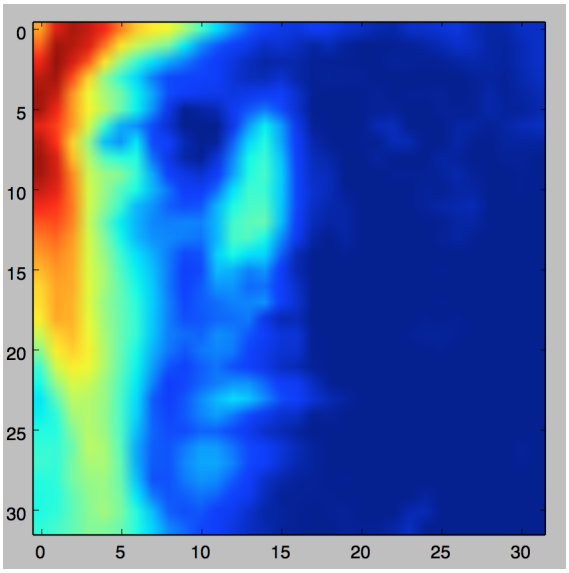
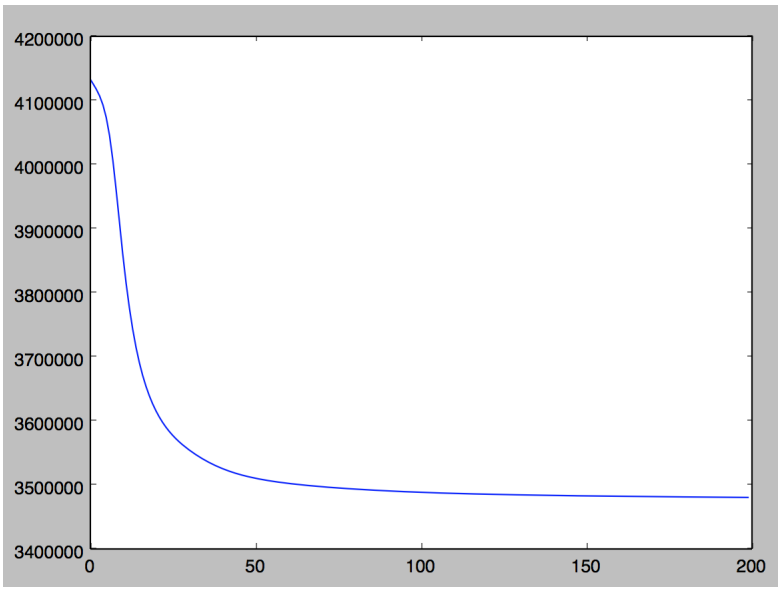


Image 500



W_{10}, corresponding to biggest value in H for image 500.

Part 2, documents



Objective function for the Divergence penalty, as function of iteration

Index	Word	Topic Probability
68	police	0.025167
89	charge	0.020731
7	man	0.016437
170	officer	0.014025
406	crime	0.013425
559	arrest	0.012996
18	case	0.010385
630	prison	0.010042
751	criminal	0.009908
405	trial	0.009796

Table 5: Topic 1: Criminal Justice

Index	Word	Topic Probability
10	school	0.036812
59	student	0.027946
21	child	0.014908
283	class	0.012564
221	community	0.012147
14	program	0.012111
410	education	0.011804
11	group	0.011467
359	college	0.011248
508	teacher	0.010296

Table 6: Topic 5: Education

Index	Word	Topic Probability
271	food	0.018212
877	fresh	0.012532
467	restaurant	0.010927
145	serve	0.010552
919	taste	0.009057
742	eat	0.008611
763	dinner	0.007397
1045	cook	0.007365
1079	fish	0.007356
42	add	0.007256

Table 7: Topic 10: Restaurants

Index	Word	Topic Probability
50	money	0.017702
40	pay	0.016685
3	state	0.015025
183	bill	0.014939
258	budget	0.014762
135	tax	0.013915
92	cut	0.011469
87	cost	0.011361
14	program	0.010877
9	plan	0.010111

Table 8: Topic 15: Government Budgeting

Index	Word	Topic Probability
1	company	0.039698
80	sell	0.019637
35	market	0.017051
132	sale	0.017008
37	business	0.016799
114	share	0.014053
113	buy	0.013014
70	executive	0.012504
141	stock	0.012028
171	industry	0.011061

Table 9: Topic 20: Business