

Learning Probabilistic Graphical Models

Assignment 1

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Conditional Independencies in Bayesian Networks

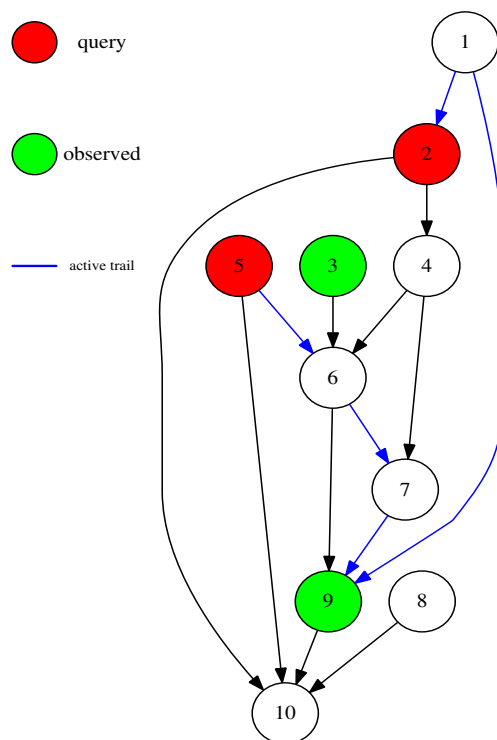


Figure 1: Bayesian Network with trail

Explanation

- **Data structures used** A structure is maintained corresponding to every node of bayesian network which includes the information of its parents and children along with vector which store information whether the ball has already passed through the node towards its children and its parents. Along with this two boolean are also maintained that tells whether the node is observed node and second to predict whether it is d-separated or not. Besides, a vector is also maintained at every node that shows the most recent trail from Xi to that node.

OCR character Recognition using Graphical Models

Table 1: Small TestCase

Sno	OCR	Transition	Combined
Word Wise Accuracy	8.65385	25.9615	35.5769
Character wise Accuracy	53.9216	66.2745	71.1765
Likelihood	-7.80833	-7.09707	-6.27953

Table 2: Large TestCase 1

Sno	OCR	Transition	Combined
Word Wise Accuracy	11.1974	24.0402	31.4899
Character wise Accuracy	58.3936	68.0465	70.8398
Likelihood	-7.87635	-7.17574	-6.27186

Table 3: Large TestCase 2

Sno	OCR	Transition	Combined
Word Wise Accuracy	10.0091	24.1773	31.8099
Character wise Accuracy	57.258	67.6893	70.7208
Likelihood	-7.87404	-7.17419	-6.2713

Table 4: Large TestCase 3

Sno	OCR	Transition	Combined
Word Wise Accuracy	9.91773	24.6801	31.947
Character wise Accuracy	57.2488	67.8725	70.6292
Likelihood	-7.86572	-7.1671	-6.26506

Table 5: Large TestCase 4

Sno	OCR	Transition	Combined
Word Wise Accuracy	11.4717	24.6801	31.8556
Character wise Accuracy	57.5785	68.248	70.7757
Likelihood	-7.86982	-7.17084	-6.26793

Table 6: Large TestCase 5

Sno	OCR	Transition	Combined
Word Wise Accuracy	11.5631	26.691	33.3181
Character wise Accuracy	58.531	68.4587	71.0688
Likelihood	-7.85745	-7.15843	-6.25789

Words from small testcase

correct = ado ocr = ads transition = ado
 correct = arad ocr = arae transition = arad
 correct = ared ocr = ardd transition = ared
 correct = diter ocr = eiedr transition = diter
 correct = dorte ocr = dorttr transition = dorte
 correct = hent ocr = ohnt transition = hent
 correct = noon ocr = nssn transition = nson combined = noon
 correct = ratoon ocr = raessn transition = rathon combined = ratoon
 correct = seeder ocr = httdtr transition = steder combined = seeder

Words from large testcase 1

correct = add ocr = aaa transition = ada combined = add
 correct = adder ocr = addtr transition = adder
 correct = adonin ocr = aeonin transition = adonin
 correct = adorer ocr = ddohth transition = adorth combined = adorer
 correct = adorn ocr = adohn transition = adorn
 correct = aerate ocr = atratt transition = atrate combined = aerate
 correct = ahorse ocr = ahorhe transition = ahorse
 correct = air ocr = aih transition = air
 correct = ananas ocr = aaaaas transition = ananas
 correct = arenae ocr = ahdnad transition = arenad combined = arenae
 correct = arnee ocr = arahh transition = arate combined = arnee
 correct = asta ocr = ssts transition = ssta combined = asta

Words from large testcase 2

correct = added ocr = aiiei transition = aided combined = added
correct = ade ocr = add transition = ade
correct = adion ocr = aiion transition = adion
correct = ado ocr = ads transition = ado
correct = adorer ocr = aaoheh transition = adorer
correct = aion ocr = aisn transition = aion
correct = ana ocr = nnn transition = ann combined = ana
correct = anan ocr = aaaa transition = anan
correct = anenst ocr = anhnht transition = aneast combined = anenst
correct = anent ocr = aaeat transition = aneat combined = anent
correct = anoa ocr = naon transition = anon combined = anoa
correct = anotto ocr = anoiio transition = anotio combined = anotto

Words from large testcase 3

correct = adder ocr = addhh transition = adder
correct = ade ocr = sdt transition = ade
correct = ado ocr = ddh transition = ado
correct = adore ocr = adhre transition = adore
correct = adorer ocr = sdohdh transition = adorer
correct = aider ocr = aiitr transition = aider
correct = annona ocr = daasad transition = anasan combined = annona
correct = ansar ocr = dasdr transition = dasar combined = ansar
correct = arad ocr = shsd transition = shad combined = arad
correct = area ocr = dred transition = ared combined = area
correct = arenae ocr = nreane transition = areane combined = arenae
correct = ashes ocr = nhheh transition = ashed combined = ashes

Words from large testcase 4

correct = addend ocr = aaaena transition = aidena combined = addend
correct = ado ocr = nao transition = ado
correct = aerate ocr = ahraeh transition = serate combined = aerate
correct = aide ocr = aidh transition = aide
correct = anan ocr = nnnn transition = anan
correct = anear ocr = snesr transition = anear
correct = anend ocr = snhnd transition = anend
correct = anes ocr = ands transition = anes
correct = annat ocr = daadi transition = anant combined = annat
correct = anoine ocr = nnhdnt transition = nasine combined = anoine
correct = anotto ocr = dnoeeo transition = anoteo combined = anotto

correct = arain ocr = nhndn transition = arnin combined = arain

Words from large testcase 5

correct = adonin ocr = ndsndn transition = adonin
correct = adore ocr = adhhe transition = adore
correct = adorer ocr = sdorer transition = adorer
correct = adorn ocr = aohn transition = adorn
correct = aenean ocr = ahnhan transition = denean combined = aenean
correct = ait ocr = aii transition = ait
correct = anear ocr = dnhdr transition = anear
correct = ansate ocr = aasaed transition = nasate combined = ansate
correct = aread ocr = ahdae transition = arene combined = aread
correct = arenae ocr = srense transition = arene combined = arenae
correct = aroast ocr = dhodst transition = aronst combined = aroast
correct = aster ocr = asttth transition = asteth combined = aster

Results Obtained on Varying the Potentials

Change in Both the potentials

	Power of OCR/Trans potentials	Likelihood	WordAccuracy	CharacterAccurcay
0.5	-10.3636	0	16.0784	
1	-6.27953	35.5769	71.1765	
2	-4.39931	35.5769	71.1765	
3	-3.4859	35.5769	71.1765	
4	-3.06025	34.6154	70.1961	
5	-2.89081	34.6154	66.2745	
6	-2.86293	33.6538	69.4118	

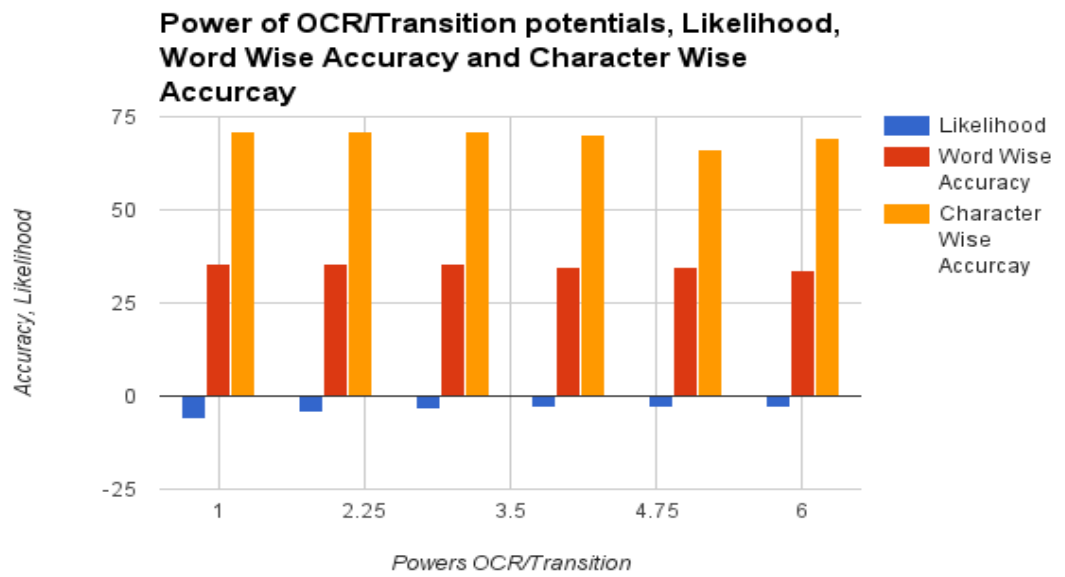


Figure 2: Graph representing the Accuracy and Likelihood

change in OCR potentials

Power of OCR potentials Likelihood WordAccuracy Character Accuray 0.5 -
6.58836 29.80769 66.8627
1 -6.27953 35.5769 71.1765
2 -4.81808 29.8077 66.8627
3 -4.12564 25.9615 64.902
4 -3.80144 25 63.9216
5 -3.67334 25 64.1176
6 -3.65961 24.0385 63.5294

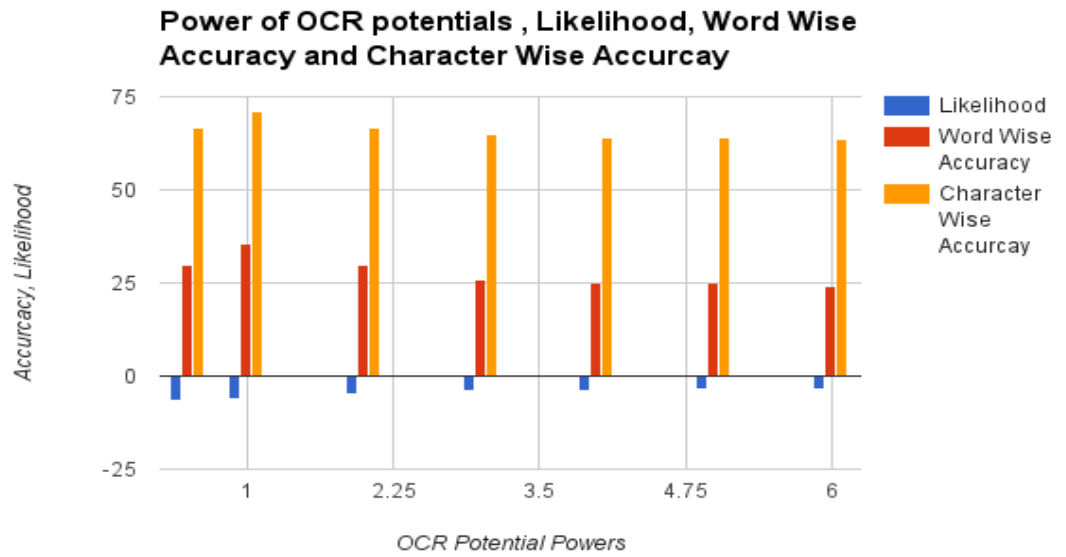


Figure 3: Graph representing the Accuracy and Likelihood

change in Transition potentials

Power of Transition potentials	Likelihood	WordAccuracy	CharacterAccurcay
0.5	-6.58836	29.80769	66.8627
1	-6.27953	35.5769	71.1765
2	-5.86052	32.6923	66.8627
3	-5.62398	28.8462	63.7255
4	-5.51076	25	60.1961
5	-5.48796	19.2308	56.2745
6	-5.53633	14.4231	52.9412

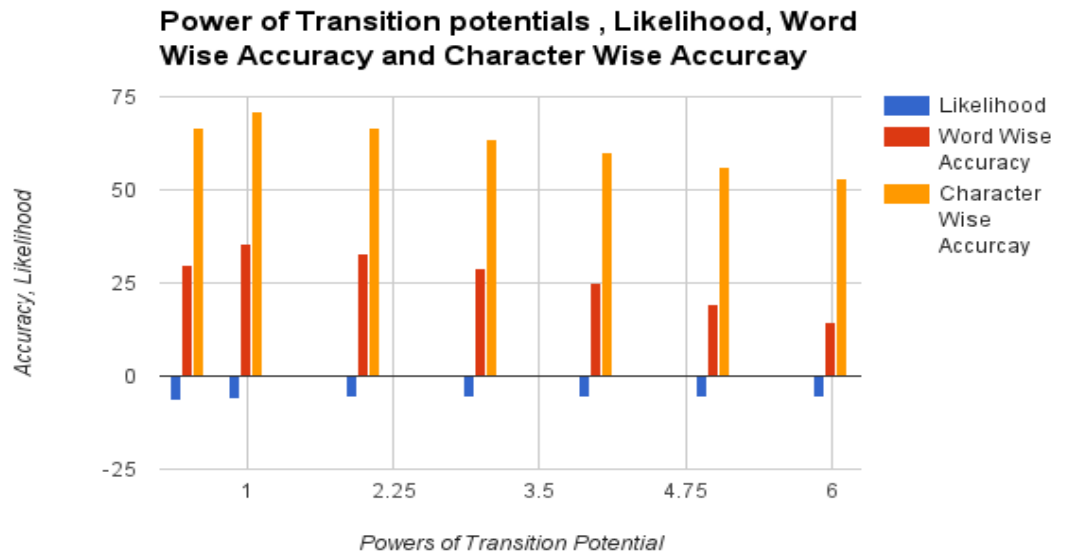


Figure 4: Graph representing the Accuracy and Likelihood

It has been concluded that change in the skip potentials is not having any effect on the accuracy value or likelihood where as change in ocr potentials , Transition potentials effects on the Accuracy and likelihood is being shown by the graph.