CSE422 (IBU)
Practice Sheet
Gradient Descent and Decision Tree

Gradient Descent on Univariate Linear Regression

In a linear regression model we relate the output y with input feature x using the formula $y = w_o + w_1 x$.

Question: For each of the datatables given below, using Least Square Method estimate the value of w_0 and w_1. Then use the Gradient Descent algorithm to improve your estimation. Let the learning parameter α be a constant.

Table 1.

X	Y
0	3
0.10101	3.20202
0.20202	3.40404
0.30303	3.606061
0.40404	3.808081
0.505051	4.010101
0.606061	4.212121
0.707071	4.414141
0.808081	4.616162
0.909091	4.818182

CSE422 (IBU)
Practice Sheet
Gradient Descent and Decision Tree

Table 2.

X	Y
0	3.993428
0.10101	2.925492
0.20202	4.699417
0.30303	6.65212
0.40404	3.339774
0.505051	3.541827
0.606061	7.370547
0.707071	5.949011
0.808081	3.677213
0.909091	5.903302

Table 3.

X	Y
0	0
0.10101	0.010203
0.20202	0.040812
0.30303	0.091827

CSE422 (IBU)

Practice Sheet

Gradient Descent and Decision Tree

0.40404	0.163249
0.505051	0.255076
0.606061	0.367309
0.707071	0.499949
0.808081	0.652995
0.909091	0.826446

Table 4.

X	Y
4.17411	11.38723
2.221078	11.80276
1.198654	4.603337
3.376152	17.91281
9.429097	23.7352
3.232029	6.892586
5.187906	10.16313
7.03019	18.5078
3.636296	9.602204
9.717821	24.57764

CSE422 (IBU)

Practice Sheet

Gradient Descent and Decision Tree

Question: What will happen if the learning parameter decays over time?

Decision Tree: ID3 Algorithm

For the given problems construct the Decision Tree using the ID3 algorithm (taught in class using slides).

Dataset 1: Car Buying

Attributes:
Income (Low, Medium, High)
Work Stability (Stable, Unstable)
Credit Rating (Good, Average, Poor)
Down Payment (Low, High)

Class Label:
Buy Car (Yes, No)

Income	**Work Stability**	**Credit Rating**	**Down Payment**	**Buy Car**
Low	Unstable	Poor	Low	No
Medium	Stable	Good	High	Yes
Medium	Stable	Average	Low	Yes
High	Stable	Good	High	Yes
Low	Unstable	Poor	Low	No
High	Stable	Good	High	Yes
High	Unstable	Average	High	No
Medium	Unstable	Poor	Low	No

CSE422 (IBU)
Practice Sheet
Gradient Descent and Decision Tree

Dataset 2: Job Offer

Attributes:
Skills Match (Low, Medium, High)
Company Stability (Stable, Risky)
Commute Time (Short, Medium, Long)
Expected Salary (Low, Medium, High)

Class Label:
Accept Offer (Yes, No)

Skills Match	**Company Stability**	**Commute Time**	**Expected Salary**	**Accept Offer**
Low	Risky	Long	Low	No
Medium	Stable	Short	Medium	Yes
High	Stable	Medium	High	Yes
Medium	Risky	Long	Low	No
High	Stable	Short	High	Yes
Low	Risky	Long	Low	No
High	Stable	Medium	High	Yes
Medium	Risky	Medium	Medium	No

CSE422 (IBU)
Practice Sheet
Gradient Descent and Decision Tree

Dataset 3: Loan Approval

Attributes:
Credit Score (Low, Medium, High)
Income Level (Low, Medium, High)
Loan Amount (Small, Medium, Large)
Previous Loan Default (Yes, No)

Class Label:
Loan Approved (Yes, No)

Credit Score	Income Level	Loan Amount	Previous Loan Default	Loan Approved
Low	Low	Small	Yes	No
High	High	Large	No	Yes
Medium	Medium	Medium	No	Yes
High	High	Large	No	Yes
Medium	Medium	Small	Yes	No
Low	Low	Small	Yes	No
High	Medium	Medium	No	Yes
Medium	Low	Medium	Yes	No

CSE422 (IBU)
Practice Sheet
Gradient Descent and Decision Tree

Dataset 4: University Admission

Attributes:
High School GPA (Low, Medium, High)
Entrance Exam Score (Low, Medium, High)
Volunteer Work (Yes, No)
Recommendation Letter (Weak, Strong)

Class Label:
Admitted (Yes, No)

High School GPA	Entrance Exam Score	Volunteer Work	Recommendation Letter	Admitted
Low	Low	No	Weak	No
High	High	Yes	Strong	Yes
Medium	Medium	Yes	Strong	Yes
High	High	No	Weak	No
High	Medium	Yes	Strong	Yes
Medium	High	No	Strong	Yes
Low	Low	No	Weak	No
Medium	Medium	Yes	Weak	No