2 10.063 7.404 4.15	mpPrice Income Ac 138 73 111 48 113 35		83 Good 65 1	n Urban US 7 Yes Yes 0 Yes Yes 2 Yes Yes		
4 4.15 395 12.57	113 35 117 100 141 64 138 108	4 466 3 340 	97 Medium 55 1 128 Bad 38 1 	.2 Yes Yes .4 Yes Yes .3 Yes No .4 Yes Yes		
396 6.14 397 7.41 398 5.94 399 9.71	139 23 162 26 100 79 134 37	3 37 12 368 7 284	120 Medium 55 1 159 Medium 40 1 95 Bad 50 1	1 No Yes 8 Yes Yes 2 Yes Yes 6 Yes Yes		
	scribe() .000000					
mean 7 std 2 min 0 25% 5 50% 7 75% 9 max 16	.496325 .824115 .000000 .390000 .490000 .320000 .270000 dtype: float64					
#Changing the df1 = pd.get #Converting	he categorical va t_dummies(df) the Target varia ry'] = pd.cut(df1	ariables into dummie able i.e. Sales into L['Sales'], s=[0,10, np.inf],				
df1 Sales Co	labe incl	els=['Low/Mid','High Lude_lowest =True)		c_Bad ShelveLoc_Good Shelve	eLoc_Medium Urban_No Urban_Yes US	S_No US_Yes Category
0 9.501 11.222 10.063 7.40	138 73 111 48 113 35 117 100	11 276 16 260 10 269 4 466	120 42 17 83 65 10 80 59 12 97 55 14	1 0 0 1 0 0 0 0 0 0	0 0 1 0 0 1 1 0 1 1 0 1	 0 1 Low/Mid 0 1 High 0 1 High 0 1 Low/Mid
4 4.15 395 12.57 396 6.14 397 7.41	141 64 138 108 139 23 162 26	 17 203 3 37	128 38 13 128 33 14 120 55 11 159 40 18	1 0 0 1 0 0 0 0 0	0 0 1 0 0 1 1 1 0 1 0 1	1 0 Low/Mid 0 1 High 0 1 Low/Mid 0 1 Low/Mid
397 7.41 398 5.94 399 9.71 400 rows × 16 co	162 26 100 79 134 37 olumns	7 284	159 40 18 95 50 12 120 49 16	0 0 1 0 0 1	1 0 1 0 0 1 0 0 1 0 0 1	0 1 Low/Mid 0 1 Low/Mid 0 1 Low/Mid
x1 = df1.ilc y1 = df1.ilc x1 CompPrice	oc[:,15]	na Populati	qe Education C	Shelvel on Control	edium Urban No. 111	IS Yes
CompPrice 0 138 1 111 2 113 3 117	3 73 1 L 48 1 3 35 1	11 276 120 16 260 83 10 269 80	ge Education ShelveLoc_Bad 42 17 1 65 10 0 59 12 0 55 14 0	0 1 0	ledium Urban_No Urban_Yes US_No U 0 0 1 0 0 0 1 0 1 0 1 0 1 0 1 0	1 1 1 1
4 141 395 138 396 139	1 64 3 108 1	3 340 128	38 13 1 33 14 0 55 11 0	0 1 0	0 0 1 1 0 0 1 0 1 1 0 0	0 1 1
398 100 399 134 400 rows × 14 co	79 4 37	7 284 95	40 18 0 50 12 1 49 16 0	0 0 1	1 0 1 0 0 0 1 0 0 0 1 0	1 1 1
y1 0 Low/M: 1 Hig 2 Hig 3 Low/M:	gh gh id					
4 Low/M: 395 Hig 396 Low/M: 397 Low/M: 398 Low/M: 399 Low/M:	id gh id id id id	.1.				
Name: Categories (2 # Splitting x_train, x_t	ry, Length: 400, 2, object): ['Low <i>data into traini</i> test,y_train,y_te	w/Mid' < 'High'] ing and testing data est = train_test_spl	it(x1,y1, test_size=0.25,	·		
Iteration model1 = Dec	n-1: Max D	epth = 2	fier using Entro	уру Спіeria		
<pre>model1.fit() preds1 = mod print('Model pd.Ser 'Model</pre>	x_train,y_train) del1.predict(x_te l leaves:',model1 ries(preds1).valu l Accuracy is:',n	est) # predicting or L.get_n_leaves(),'\r ue_counts(),'\n','\r np.mean(preds1==y_te	n test data set			
High 19 dtype: int64	81 9					
<pre>lteration model2 = Dec model2.fit()</pre>	1-2: Max D cisionTreeClassif	-	ntropy',max_depth=3) n test data set			
print('Model pd.Ser 'Model Model leaves	l leaves:',model2 ries(preds2).valu l Accuracy is:',n	est) # predicting or 2.get_n_leaves(),'\r ue_counts(),'\n','\r np.mean(preds2==y_te	n','\n', n',			
High 19 dtype: int64 Model Accura	acy is: 0.76)enth – 4				
<pre>model3 = Dec model3.fit(> preds3 = mod print('Model</pre>	x_train,y_train) del3.predict(x_te l leaves:',model3	Fier(criterion = 'erest) # predicting or B.get_n_leaves(),'\r	n','\n',			
pd.Ser 'Model Model leaves Low/Mid 8 High 19	ries(preds3).valu l Accuracy is:',n : 12 81 9	3.get_n_leaves(),'\r ue_counts(),'\n','\r np.mean(preds3==y_te	ι',			
Model Accura	acy is: 0.8 1-4: Max D	•				
<pre>model4.fit(> preds4 = mod print('Model pd.Ser</pre>	x_train,y_train) del4.predict(x_te l leaves:',model4 ries(preds4).valu	Fier(criterion = 'er est) # predicting or 4.get_n_leaves(),'\r ue_counts(),'\n','\r np.mean(preds4==y_te	n','\n', n',			
Model leaves Low/Mid High 22 dtype: int64	: 18 78 2	σωπτρι eas4==y_te				
Iteration model5 = Dec		•	ntropy',max_depth=6)			
<pre>model5.fit() preds5 = mod print('Model pd.Ser</pre>	l leaves:',model5 ries(preds5).valu l Accuracy is:',n	est) # predicting or 5.get_n_leaves(),'\rue_counts(),'\n','\rup.mean(preds5==y_te	n','\n', n',			
Low/Mid { High 17 dtype: int64	83 7					
model6 = Dec	x_train,y_train)	•	ntropy',max_depth=7) n test data set			
pd.Ser 'Model Model leaves Low/Mid 8	ries(preds6).valu l Accuracy is:',n : 28	G.get_n_leaves(),'\rue_counts(),'\n','\rup.mean(preds6==y_te	ι',			
High 17 dtype: int64 Model Accura	7 acy is: 0.82	fier model a	t the end of iter	ation 5 has the	max accuracy i.e. 8	3%
	ification_report(precision re 0.53	<pre>(preds5,y_test))</pre>	upport 17 83	•	, -5. 0	
accuracy macro avg weighted avg	0.72 0.85	0.84 0.74 0.73 0.84 0.84	100 100 100	ng Gini Criteria		
from sklearr model_gini =	n.tree import Dec	cisionTreeClassifier assifier(criterion=	. ,	J Jun Ontella		
#Prediction predG=model_ print('Model		ne accuracy	et))			
	ccuracy is	s achieved ι th the Decis	using CART as	well		
fig = plt.fi fig = tree.p	igure(figsize=(25 olot_tree(model5, feature 'Shelve 'US_Yes	5,20)) e_names= ['CompPrice eLoc_Bad','ShelveLoc s'], filled=True)	e','Income','Advertising', c_Good','ShelveLoc_Medium	,'Population','Price','Age ','Urban_No','Urban_Yes',		
		ing Entropy',fontsiz	·	tree using Entropy		
				ShelveLoc Good <= 0.3 entropy = 0.715 samples = 300 value = [59, 241]		
		Advertising <= 9.5 entropy = 0.462 samples = 235 value = [23, 212]				Price <= 150.0 entropy = 0.992 samples = 05 value = [36, 29]
		/	Price <= 99.5 entropy = 0.764 samples = 90 value = [20, 70]			Age <= 62.5 entropy = 0.949 samples = 57 value = [36, 21]
	Price <= 94.5 entropy = 0.145 samples = 145 value = [3, 142]					
Age <= entropy =	entropy = 0.145 samples = 145 value = [3, 142]	Advertising <- entropy = 0. samples =	110.5	Income <= 99.5 entropy = 0.508 samples = 71	Population <= 318 6	Advertising <= 15. entropy = 0.837 samples = 15
Age <= entropy = samples value = [entropy = 0.145 samples = 145 value = [3, 142]	Advertising <= entropy = 0 samples = value = [12]	10.5 349 19	Income <= 99.5 entropy = 0.508 samples = 71 value = [8, 63]	Population <= 318.0 entropy = 0.792 samples = 42 value = [32, 10]	Advertising <= 15, entropy = 0.837 samples = 15 value = [4, 11]
samples	entropy = 0.145 samples = 145 value = [3, 142]	samples =	10.5 349 19	samples = 71	127.5 0.985 entropy = 0.951 samples = 27	samples = 15
entropy = 0.0 samples = 1	28.5 samples = 145 value = [3, 142] entropy = 0.0 samples = 124 value = [0, 124] Education <= 12.5 entropy = 0.469 samples = 20 value = [2, 18]	Age <= 49.5 entropy = 0.811 samples = 16	entropy = 0.0 samples = 3 value = [0, 3] entropy = 0.0 samples = 3 value = [2, 3] Price <= 111.0 entropy = 0.0 samples = 70 entropy = 0.0 samples = 70	Price <= 1 entropy = samples = 71	127.5 0.985 entropy = 0.951 samples = 27	Samples = 15 value = [4, 11] value = [4, 11] value = [4, 11] value = [4, 11] value = [4, 12] value = [4, 13] value = [4, 1
entropy = 0.0 samples = 1 value = [1, 0]	28.5 samples = 145 value = [3, 142] entropy = 0.0 samples = 124 value = [0, 124] Education <= 12.5 entropy = 0.469 samples = 20 value = [2, 18]	Age <= 49.5 entropy = 0.811 samples = 6 value = [12, 4] income <= 11 entropy = 0.0 samples = 6	entropy = 0.0 samples = 3 value = [0, 3] entropy = 0.19 samples = 57 value = [2, 55] Price <= 111.0 entropy = 0.863 samples = 7 value = [2, 5]	Price <= entropy = samples = value =	CompPrice <= 136.0 0.9811	Samples = 134.5 entropy = 0.0 samples = 8 samples
comprise = 1 value = [1, 0]	28.5 samples = 145 value = [3, 142] entropy = 0.0 samples = 124 older = [0, 124] Education <= 12.5 entropy = 0.469 samples = 20 value = [0, 124] entropy = 0.469 samples = 13 value = [0, 13] entropy = 0.0 samples = 13 value = [0, 13] igure (figsize = (25 older = (model = 0 feature	Age <= 49.5 entropy = 0.811 samples = 16 value = [12, 4] entropy = 0.918 samples = 6 value = [6, 0] entropy = 0.918 samples = 6 value = [2, 4] 6, 20)) gini, e_names = ['CompPrice	CompPrice <= 143.5	Price <-	CompPrice <= 136.0 entropy = 0.951 samples = 27 value = [17, 10] entropy = 0.938 samples = 21 value = [11, 10] entropy = 0.988 samples = 21 value = [11, 10] entropy = 0.988 samples = 21 value = [11, 10] entropy = 0.0 samples = 6, 2] entropy = 0.0 samples = 6, 2] entropy = 0.0 samples = 3 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 3 value = [0, 3] entropy = 0.0 samples = 3 value = [0, 3] entropy = 0.0 samples = 3 value = [0, 3] entropy = 0.0 samples = 3 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy = 0.0 samples = 2 value = [0, 3] entropy	Samples = 13
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comprise sample	Education = 143 samples = 143 samples = 143 samples = 124 samples = 124 samples = 124 samples = 124 samples = 13 samples = 13 value = [0, 13] entropy = 0.459 samples = 13 value = [0, 13] samples = 13 value = [0, 13] problem = 12, 13 samples = 13 value = [0, 13] samples = 13 value = [0, 13] problem = 12, 13 samples = 13 value = [0, 13] samples = 13 value = [0	entropy = 0.3	Strongy = 0.0 Samples = 3.7 Sa	Propulation', 'Price', 'Age ', 'Population', 'Price', 'Age ', 'Urban_No', 'Urban_Yes', on tree using CART The state of	# ' ' Education', ' 'US_No', ' ***	Sample 1, 13 Samp
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After coaffecting 1. Shelf Locati 2. Pricing 3. Advertising	Education = 143 samples = 143 samples = 143 samples = 124 samples = 124 samples = 124 samples = 124 samples = 13 samples = 13 value = [0, 13] entropy = 0.459 samples = 13 value = [0, 13] samples = 13 value = [0, 13] problem = 12, 13 samples = 13 value = [0, 13] samples = 13 value = [0, 13] problem = 12, 13 samples = 13 value = [0, 13] samples = 13 value = [0	entropy = 0.3	Strongy = 0.0 Samples = 3.7 Sa	Propulation', 'Price', 'Age ', 'Population', 'Price', 'Age ', 'Urban_No', 'Urban_Yes', on tree using CART The state of	Complete = 330.0 Complete = 330.0 Complete = 320.0 Complete =	Sample 1, 13 Samp