

Assignment

Solve 10 questions.

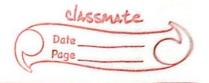
Discoss: Statistics us Data Mining us Dels Analytics us. Dels Science.

Stanstia statistics in the study of alkeling, analyzing, interpreting presenting and organizing data. It forms the foundation for many analytical methodologies and techniques. Traditional statistics preses on hypotheris testing, probability, regression and variance analysis to infor potterns and relationships within data. It's primary aim is to inderstand & explain the inderlying phenomena represented by the data through well-defined mathematical principles & model.

Dufa mining It involves exploring and analyzing large ablasely to discover patterns, trand and relationships that might not to immediately appearent. It employs algorithms and technique from machine Leoning stotistics, and database systems to uncover hidden information. Data mining is heavily used in area like market research frauch detection and customes relationship management to generate invight

that can inform decision- making processes

Dola Analytics It is the process of examining datasets to draw conclusions a bout the information they contain. It encompasses a range of methods from descriptive analytics (summarizing past data) to predictive



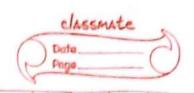
analytics (forecashing future events) and prescriptive analytics (recommending actions). Data analytics focuses on transforming van data into actionable transforming the use of various tools I technique, including statistical analysis, machine learning and data visualization

Data Science is on interdisciplinary field that combines elements of statistics, computer science and domain specific knowledge to extract meaningful insights and knowledge from data. It involves the entire data lifecycle, including data collection, cleaning, preprocessing, analysis on a visualization. Data scientists use advanced techniques like machine learning, De and AI to build medictive model and automate decision making processes. Dela science aims to solve complex problems and provide strategy insights that drive innovation of efficiency across various industries.

In summary while statistics provide the Beanefical founding for understanding data, data mining focuses on discovering perferon within large datasets. Data analytics appliese these techniques to generate actionable insights. and classe suience integrates those approaches will advanced computational tools to solve complex problems and drive decision mideing.

0		E. R
Ø	What is supervised Learning? Give concrete examples of Regression and Classification.	
<u>).</u>	Classics Line	ve where examples of regression
	and Classification.	All the second s
_7	1.	0
-9,	Supervised Learning is a n	machine learning technique where
	a model is trained on a	labeled dataset, lauming h
	morp input features to out	Jabeled dataset, lauming ho fot lebels. This enables on new, unseen data.
	model to make prediction	ns on new unseen data.
	a dela la recent de percent	nit parkets solver to the
	The two types of supe	nvised learning are:
	3/ 1 7	
	Rooksetten	Classification
	7-237007	C 1-2387 1 847 007
	Products a continuous numarial	Disabile lassiff attact Cales
	ala 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Predicts a categorical output (class or group) based on input features
-	output soved on input features.	or group bused on input feature
نڌ		
	In chemical engineering, used	In chemical engineering, classifying
-	in predicting the yield of cheminal reaction based on	In chemical engineering, classifying different types of based on their chemical composition.
	cheminal reaction based on	chemical composition.
45	temporahore, pressure and	in interest factors as fall
1	reaction t concentrations.	
	Usually used for predicting house price based on square pootage, number of bedroom & location	Clossifying emails as spom or
	one bued on square footage.	not spam
	aumber and beginning landon	The second to see the
	BEZIONO Z	The second of the case
	Charles Consinues	walst le in cheminal engineering.
	1 land in a la him	valuable in chemical engineering dels for processes like roach on evipment fault defection.
	Tox developing prodictive mo	and a set of the found of
	yieras, product quality or e	quipment fault dereenor.

8.			
R	Define Unsupervised learning give examples of Clostering and Anomaly Detection		
0.	and Anamaly Detection		
-	61101 - 1.5 G J G		
and o	Unsupervised Learning is a machine learning technique		
ince Some	where a model is trained on an unlabeled dataset,		
1	meaning the data points lack explicit output labels.		
	The model aims to discover hidden pattorns structures		
	or relationships within the data Common techniques		
	in unsupervised learning include dustening and		
	anamaly defection		
	fre sa sylvene we will have been a loss of the salary		
	Clustering Anomaly Defection		
udo) is	The letter of committee a presental the diction of the second cots		
at 1	Involves grouping similar & Involves identifying unusualar		
	ata points together based or rate data points that devicte		
12° 41 2.	their inherent characteristic significantly from the		
New Color	This model identifies closes majority of the data these		
	of data points that shoe anomalies may present		
	common feature or patter outlier, errors or events of		
	ns. interest.		
20.00	Examples: Examples:		
	- Customer Segmentation - Fraud Defection		
	- Downert autering - Network Seconity		
	- Process Ophimization in an - Anomaly Defection in Equipment		
Shoon	chemical plant Monitoring		
Turk	in denotions of heir models to make the man		
	richely enduct as his in anxioment shall detection		



Unsupervised learning fewers on finding hidden patterns in unlabeled data. Clustering groups similar data points into duston, with example including comp contomer segmentation and downant dustering. Anomaly defection identifies onusual data points, with application such as froud defection and network seconty

7. What is Reinforcement Learning? Provide example of Markou decision process. Q-loorning & Monte-Carlo methods.

Reinforcement Learning (RL) is a type of machine learning where an agent learns to make decisions by interacting with an environment. The agent takes actions in the environment provider feedback in the form of reports or pendies. The agents is to learn a policy that maximizes its comulative award over time.

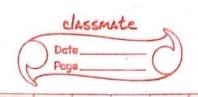
- Agent - learner & decision-maker.

- Environment - The external system the agent interaction.
- State: A representation of the corrent state of environment.

- Action: A choice made by the opent that affects the environment.
- Reward: Feedback from the or vironment indicating the goodness

or backness of the agents action.

Examples in Reinforcement Learning 1. Markov Declision Process (MDP) mathematical framework for modeling decision making in situations where obtained are pastly random and partly under the control of a devision motor. han MDP, The agent's devision-making process is divided into discrete time steps. At each time step, the agent is in a state, takes an action, receives or noward. The agent's goal is to find a policy (a mapping from states to actions) that maximizes the expected comulative raward over time 2. O-learning lourn the value of taking autions in different states. The agent maintains a cl-table, which stores the updates the d-table based on the rewards it receives, gradual learning the optimals policy. 3. Monte-Carlo methods. from complete epixodes of interactions with the environment. The agent interacts with the environment util it reaches a Comulative roward it received doing the epizals.



KI can be applied to ophimize control dischegies for chamble processes. For example, an RL agent can learn to control the temp"
I pressive of a heador to yield or minimize energy consumption. The agent can also learn to schedule batch processes or ophimize the operation of a dishillation colomn.

8. Discoss the importance of Numpy, SciPy, Mat plotlib and pandas is Dala Analysis.

NomPy

Numerical Rython (NumPy) provides the foundation for numerical compositions in tython. It introduces powerful array objects, enabling efficient strongle and manifolisher of large datasets. In chemical engineering, this is crucial for handling experimental data, simulation results, and model parameters.

It offers a wide range of mathematical functions optimized by array operations. These fonctions are essential for implementing and solving mathematical models in chemical engineering, such as mass and energy balances, reaching kinetics and transport phenomeno.

Scity Cscientific Python)

It builds upon Numby and provides additional functionality
for to scientific and technical computing. It in cludes modules
for optimization, linear algebra, integration, interpolation and
signal processing and more. It is important in solving complex

engineering problems, analyzing experimental data, and optimizing process parameters.
Scipis edeint forction is particularly useful in the

Scipis odeint function is particularly useful in the for solving ODEs that axise in dynamic models of chemical reactors, spare hon processes and other time dependent systems.

Matplot lib

It is a versatile plotting library And allows for
the creation of high quality static, animated and interaction
indivisualization. In the effective visualization is assential
for understanding complex data patterns, communicating
routs and gaining insights into process behavior.

It offers extensive customization motions enabling

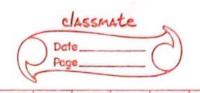
engineers to create plats taillored to their specific needs. This floribility is valuable for presenting rowlk in technical reports, publications of presentations.

Pandas

Pandos provides dada structures and data analysis how designed to work with structured dada (e.g. tables time series). It simplifies tasks like data cleaning filling, transforming & aggregation, which are common in chemical engineering data analysis.

chemical engineering bata analysis.

Panda integrates went with other libraries lite Wordy and Malphollib, making it powerful tool for analyzing in experimental data, exploring relationships beloveen variables and preparing data for modeling & simulation



In ownmary. Numby, SciPy, Matplotlib and Pandas form a robust ecosystem for data analysis in chemical engineering. They provide the essential tools for numerical computation, scientific computing, data visualization and data manipulation, enabling engineerings to effectively at analyze data, develop and validate models and optimize processes.

9. List some of the Machine learning Core libraries in Python.

- Scikit -learn

A comprehensive library for various machine learning algorithms including classification, regression, clustering and dimensionality reduction.

A powerful open-source library developed by Google for building & training deep neural networks.

Theano or note, providing a user friendly interface for building letraining deep learning models.

An open-source machine learning library known for its dynamic computational graph & flexibility in building complex models.

These libraries provide a wide range of tools of

