STA 3180 Statistical Modelling: Graphical Models

STA 3180 Statistical Modelling - Graphical Models

Graphical models are a type of probabilistic model that uses graphical structures to represent the relationships between random variables. They are used to represent complex systems and provide a way to visualize the dependencies between variables.

Key Concepts

* **Probability Distribution**: A probability distribution is a mathematical function that describes the likelihood of a particular outcome occurring. It is used to describe the behavior of a random variable.

* **Graphical Model**: A graphical model is a type of probabilistic model that uses graphical structures to represent the relationships between random variables.

* **Conditional Probability**: Conditional probability is the probability of an event occurring given that another event has already occurred.

* **Bayesian Network**: A Bayesian network is a type of graphical model that uses directed acyclic graphs (DAGs) to represent the relationships between random variables.

* **Markov Network**: A Markov network is a type of graphical model that uses undirected graphs to represent the relationships between random variables.

Definitions

* **Probability Distribution**: A probability distribution is a mathematical function that describes the likelihood of a particular outcome occurring. It is used to describe the behavior of a random variable.

* **Graphical Model**: A graphical model is a type of probabilistic model that uses graphical structures to represent the relationships between random variables.

* **Conditional Probability**: Conditional probability is the probability of an event occurring given that another event has already occurred.

* **Bayesian Network**: A Bayesian network is a type of graphical model that uses directed acyclic graphs (DAGs) to represent the relationships between random variables.

* **Markov Network**: A Markov network is a type of graphical model that uses undirected graphs to represent the relationships between random variables.

Coding Examples

Example 1: Calculating Conditional Probability

```
Start of Code
// Calculate the conditional probability of event A given event B
let A = 0.2;
let B = 0.4;
let conditionalProbability = A/B;
console.log(conditionalProbability);
End of Code
```

Example 2: Constructing a Bayesian Network

```
Start of Code
// Construct a Bayesian network with three nodes
let node1 = {
    name: "Node 1",
    parents: [],
    children: ["Node 2", "Node 3"]
};
let node2 = {
    name: "Node 2",
    parents: ["Node 1"],
    children: ["Node 3"]
};
let node3 = {
    name: "Node 3",
    parents: ["Node 1", "Node 2"],
    children: []
};
let bayesianNetwork = [node1, node2, node3];
console.log(bayesianNetwork);
End of Code
```

Practice Multiple Choice Questions

Q1. What is a graphical model?

A. A type of probabilistic model that uses graphical structures to represent the relationships between random variables.

Q2. What is a Bayesian network?

A. A type of graphical model that uses directed acyclic graphs (DAGs) to represent the relationships between random variables.