1. **Credit card fraud detection**: Bayesian inference can identify patterns or clues for credit card fraud by analysing the data and inferring probabilities with **Bayes’ theorem**. Credit card fraud detection may have false positives due to incomplete information. After an unusual activity is reported to enterprise risk management, Bayesian neural network techniques are used on the customer profile dataset that includes each customer’s financial transactions over time. These analyses confirm whether there are any indications of fraudulent activities.
2. **Spam filtering**: Bayesian inference allows for the identification of spam messages by using Bayes’ theorem to construct a model that can tell if an email is likely to be spam or not. The Bayesian model trained using the Bayesian algorithm will take each word in the message into account and give it different weights based on how often they appear in both spam and non-spam messages. **Bayesian neural networks** are also used to classify spam emails by looking at the probability of an email being spam or not based on features like number of words, word length, presence/absence of particular characters etc.
3. **Medical diagnosis**: Bayes’ theorem is applied in medical diagnoses to use data from previous cases and determine the probability of a patient having a certain disease. Bayesian inference allows for better prediction than traditional statistic methods because it can take into account all the factors that may affect an outcome and provide probabilities instead of just binary results. Bayes’ theorem is used to compute posterior probabilities, which are combined with clinical knowledge about diseases and symptoms to estimate the likelihood of a condition. Bayesian inference is used in the diagnosis of **Alzheimer’s disease**by analysing past patient data and finding a pattern that can indicate whether a person has this condition. Bayes’ theorem is especially useful for **rare diseases**that may occur infrequently and require a large amount of data to make accurate predictions.
4. **Patterns in customer dataset/marketing campaign performance**: Bayesian nonparametric clustering technique is used to find hidden patterns in data. **Bayesian nonparametric clustering technique (BNC)** is a powerful method that can be applied to various datasets such as customer datasets or marketing campaign performance. It helps find hidden patterns in data because Bayesian machine learning does not require any assumptions about the distribution of input variables. BNC enables you to find clusters that are statistically significant and can be generalized across other datasets as well.
5. **Forensic analysis**: Bayesian inference can be used in Bayesian machine learning to infer the identity of an individual based on DNA evidence. Bayes’ theorem is applied for forensic analysis, which involves reasoning about conditional probabilities and making statistical inferences from observed data (genetic marker alleles) with respect to one or more populations of possible genotypes under study.
6. **Reconstructing clean images from noisy images**: Bayes’ theorem is used in Bayesian inverse problems such as **Bayesian tomography**. Bayesian inference can be applied to the problem of reconstructing images from noisy versions of those images using **Bayes’ theorem and Markov Chain Monte Carlo (MCMC) algorithms**.
7. **Weather prediction**: Bayesian inference can be used in Bayesian machine learning to predict the weather with more accuracy. Bayes’ theorem can be applied for predicting real-time weather patterns and probabilities of rain based on past data such as temperature, humidity, etc. Bayesian models compare favourably against classical approaches because they take into account the historical behaviour of the system being modeled and provide a probability distribution over the possible outcomes of the forecast.
8. **Speech emotion recognition**: Nonparametric hierarchical neural network (NHNN), a lightweight hierarchical neural network model based on Bayesian nonparametric clustering (BNC), can be used to recognize emotions in speech with better accuracy. NHNN models generally outperform the models with similar levels of complexity and state-of-the-art models in within-corpus and cross-corpus tests. Through clustering analysis, it is shown that the NHNN models are able to learn group-specific features and bridge the performance gap between groups.
9. **Estimating gas emissions**: The recent findings suggest that a large fraction of anthropogenic methane emissions is represented by abnormal operating conditions of oil and gas equipments. As such, effective mitigation requires rapid identification as well as repairs for faulty sources controlled via advanced sensing technology or automatic fault detection algorithms based on recursive Bayes’ techniques.
10. **Federated analytics (Faulty device detection, malfunctions)**: Bayesian approach can be applied to federated analytics, a new approach to data analytics involving an integrated pipeline of machine learning techniques. The Bayesian hierarchical model allows the user to interrogate the aggregated model and automatically detect anomalies that could indicate faulty devices, malfunctions, or other such problems with remote assets/sensor networks. Federated learning is the methodology that provides a means of decentralized computations for machine learning without a need for moving local data of users. In each round of the federated learning, the participating devices train a model on their respective local data and send only an encrypted update to the aggregator. The aggregator combines updates from all participants to improve a shared model followed by its distribution to all participants.
11. **Help robots make decisions**: Bayesian inference is used in robotics to help robots make decisions. Bayes’ theorem can be applied by using real-time sensor information from the robot’s environment and inferring about its next move or action based on previous experiences. Robots will use Bayes’ theorem for extracting relevant features such as speed, the direction of movement, obstacles, and other objects in the environment. Bayesian reinforcement learning can be applied to robot learning. **Bayesian reinforcement learning (BRL)**uses Bayes’ theorem to compute the probability of taking a certain action based on previously learned experiences/knowledge and observations received from sensory information. BRL has been shown to outperform other machine learning algorithms such as deep Q-learning, Monte Carlo Tree Search, and Temporal Difference Learning.
12. **Optical character recognition (OCR)**: Bayesian inference can be used in Bayesian machine learning to improve optical character recognition (OCR) performance. Bayes’ theorem is applied for OCR, which involves the transformation of images captured on paper-based media into text strings that are computer-readable. Bayesian approaches have been shown to provide more accurate results compared with conventional machine learning algorithms.