Université Kasdi Merbah Ouargla
Faculté des nouvelles technologies de l'information et de la communication
Département d'informatique et technologie d'information

Module: Machine Learning I

Academic Year: 2021/2022

Date: 15/15/2022.

Final Exam

First/Last Name:…….

Exercice1 (8 pt.) :

Q1 . Assign each of the following features to the appropriate type of AI. **(2.5 pt.)**

1. Basic and purely reactive
2. Rely on the internal concept of the world.
3. Can form representations about themselves
4. Absorb learning data and improve over time
5. behave the same way when they encounter the same situation
6. Builds representations, remember experiences and handles new situations.
7. Has consciousness
8. Can learn from past experiences

Reactive machines	**Theory of mind**	**Limited memory**	**Self-awareness**
1,5	3	2,4,8,6	7

Q2. Assign each of the following features to the appropriate type of Machine Learning (ML). **(2.5 pt.)**

1. Uses small amount of labeled data with
2. Trained using labeled examples

3. Used for navigation.
4. Blindly explore the data and find some structure within.
5. Based on the principle of trial and error
6. Doesn't need historical labels
7. Used in applications where historical data predicts likely future events.
8. K-means clustering
9. KNN classifier

Supervised	**Reinforcement**	**Unsupervised**	**Semi-supervised**
2,7,9	3,5	4,6,7	1

Q3 . A machine learning algorithm aims at reducing the **Loss**. What are the querculanes of using Log- over Squared-Loss. **(1.5 pt.)**

- The model never converges
- The model rapidly converges
- ✓ The model Slowly Converges
- ✓ The model yields higher accuracy
- The model yields lower accuracy.

Q4. ML is a method of data analysis that is: **(1.5 pt.)**

- Use predefined set of rules.
- ✓ Makes its own set of rules.
- Doesn't need rules.

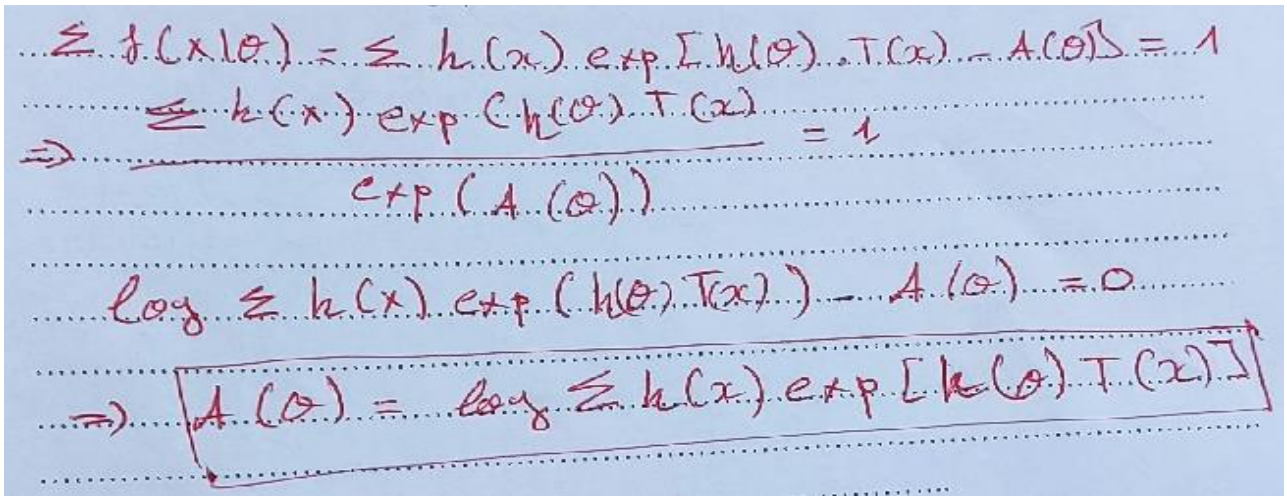
Exercise 2 (6 pt.):

Q1 . Using the closed form solution of linear regression, the output Y can be tuned using the equation: **(1.5 pt.)**

- $Y = \theta(X^t X)X$

- ✓ $Y = X\theta$
- ○ $Y = X(X^tX)\theta$
- ○ $Y = X\theta X^{-1}$

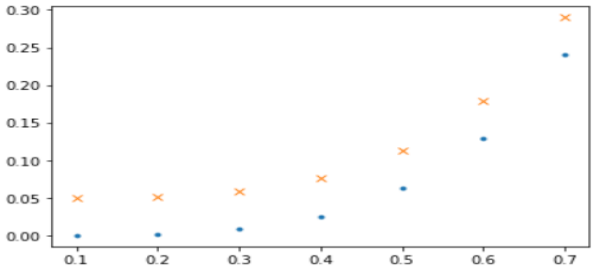
Q2 . Given that the PDF of the exponential family is $f(x \mid \theta) = h(x)exp[\eta(\theta) \cdot T(x) - A(\theta)]$. For the sum of the distribution to be equal to 1, proof that A(θ) must be: $A(\theta) = \log \sum h(x)\exp(\eta(\theta) \cdot T(x))$. **(3 pt.)**



Q3 . A Poisson distribution is characterized by the PMF $\Pr(X = k) = \frac{\lambda^k e^{\lambda}}{k!}$. The natural exponential form of this distribution can be written as: **(1.5 pt.)**

- ○ $k! \times \exp(k \times log\lambda - \lambda)$
- ✓ $\frac{\exp(k \times log\lambda - \lambda)}{k!}$
- ○ $\lambda! \times \exp(k \times log\lambda - k)$
- ○ $\frac{\exp(k \times log\lambda - k)}{\exp(k \times log\lambda - k)}$
- ○ $\exp(k \times log\lambda - k)$

<u>Exercise 3 (6 pt.):</u> Suppose that we want to train an SVM using datapoints plotted as follow.



Q1 . Which among the following arguments is correct: **(2 pt.)**

- The datapoints are not separable.
- The datapoints may be separated using a linear SVM
- The datapoints may be separated using a gaussian kernel-based SVM.
- ✓ The datapoints may be separated using a polynomial kernel-based SVM.

Q2 . If we chose to employ a polynomial kernel, which among the followings can be consider as a valid kernel: **(2 pt.)**

- $K(x,y)= y + (5^{-3} + x^4)$
- ✓ $K(x,y)= y - (5^{-3} + x^4)$
- $K(x,y)= y \times (5^{-3} + x^3)$
- $K(x,y)=$

Q3 . Which among the followings are correct arguments about Decision Trees. **(2 pt.)**

- Requires few number of parameters.
- Are not prone to overfitting
- ✓ fast because they're "greedy"
- hard to interpret
- can be used for classification problems only
- imbalanced classes doesn't pose an issue for DT.

Best of Luck