# Sample Mid-Semester Examination Question Paper T. E. (Mechanical Engineering) Subject: Artificial Intelligent and Machine Learning

**Mid-Semester Examination T. E. (Mechanical Engineering)**

**Subject: Artificial Intelligent and Machine Learning**

**Time: 1.30 hours**                                                   **Marks: 30**
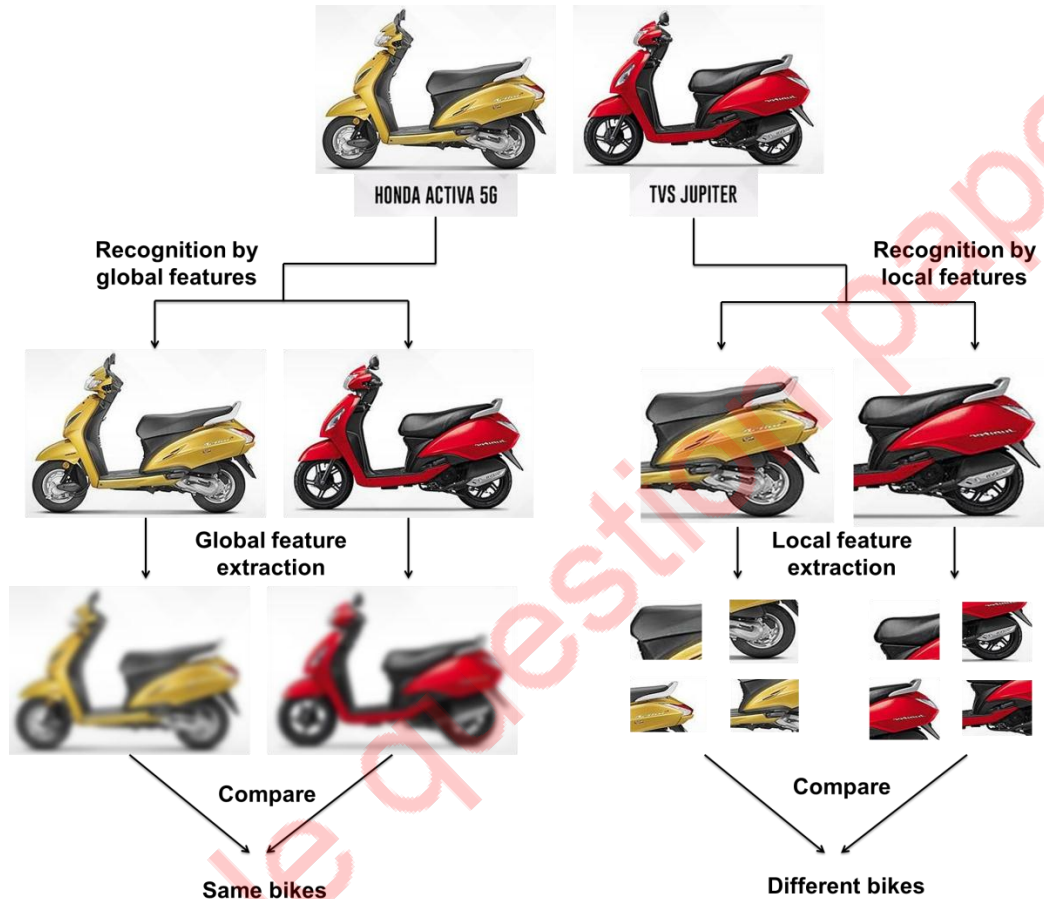
1   Define and explain following terms with respect to example given below.      2

     a.   Global feature                           b.   Local feature



2   Represent over-fitting and under-fitting in regression problem pictorially. State one real-life example.      4

3   Explain mathematics behind PCA (Principal Components Analysis).      4

4   Suppose you have a several pictures of Nuts, Bolts, Washers and Locating Pins with different orientations. You need to develop an intelligent classification model. Which approach of machine learning will you select – supervised or unsupervised? How?      4

**OR**

4 Explain role of reinforcement learning in following example. Identify environment, agent, different actions, reward, punishment etc. Draw its block diagram.
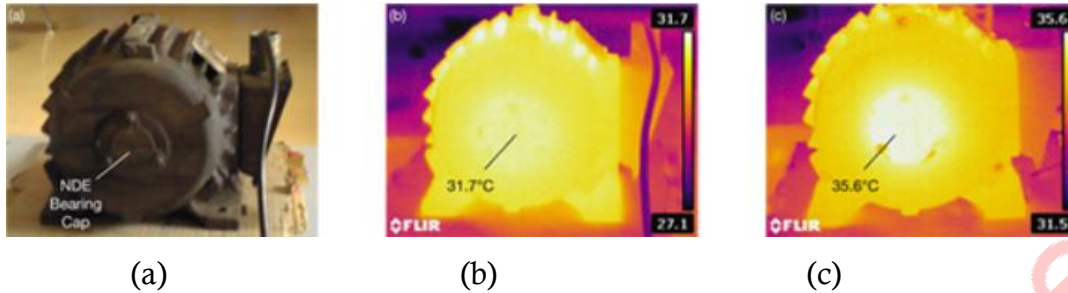
4
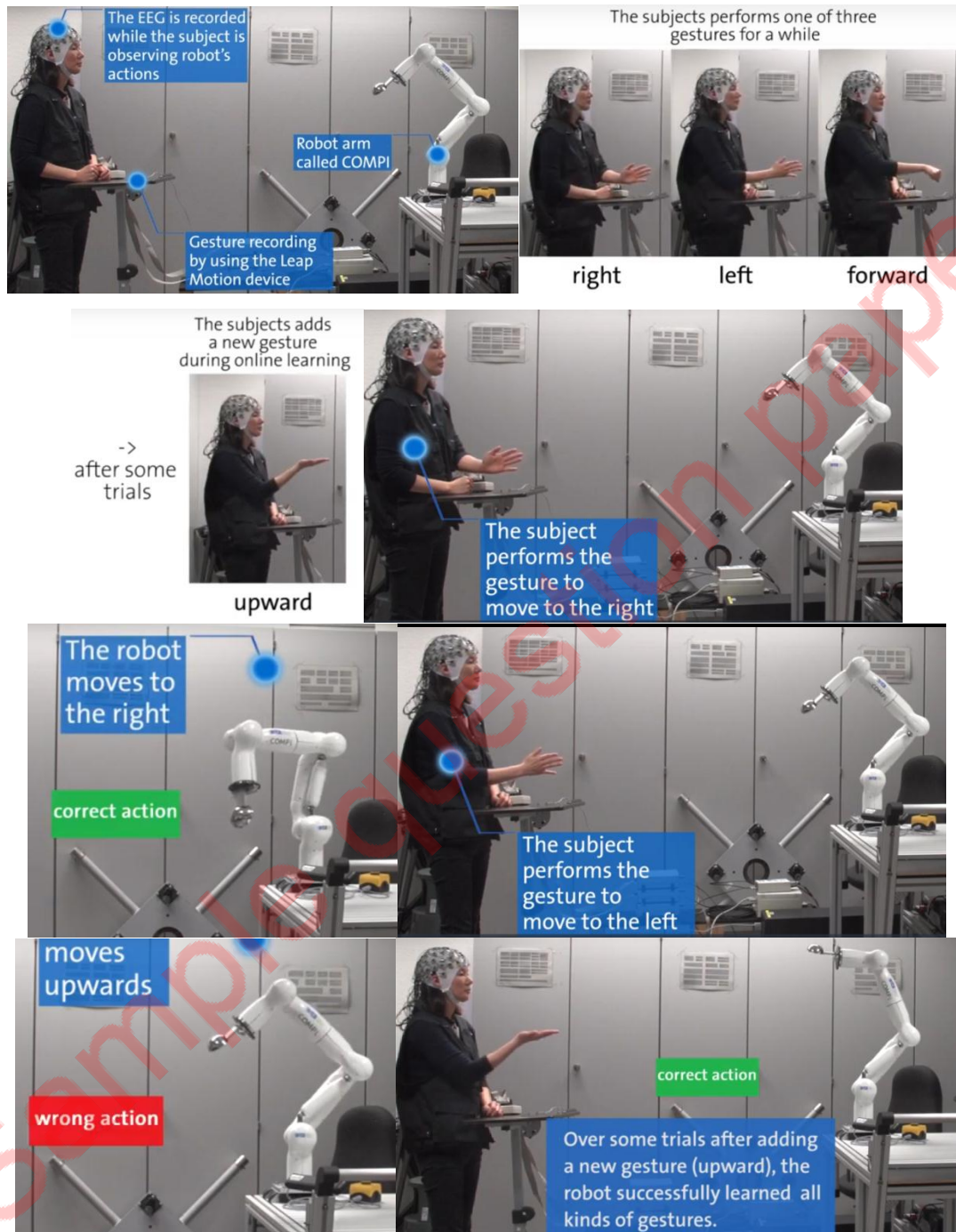


5 Explain feature ranking as a feature selection method. 4

**OR**

5 What does 'Root Node', 'Leaf Node', and 'Branch node' represent in decision tree model? Represent them pictorially. 4

6    Following picture represent an external temperature rise at the non-drive end    2
(NDE) bearing cap of a motor which is detected by comparing normal and
abnormal thermographic images.



|   (a)   |   (b)   |   (c)   |

(a) motor

(b) normal thermographic image

(c) abnormal thermographic image

In order to develop machine learning based classification model, which features
will you extract from these images so as to depict difference between two.

**OR**

6    Following figure represent time history of relative velocity change $dv/v$ with two
sigma standard deviations for stack of 5 days in the time intervals (a) September
2010 through May 2015 and (b) July 2014 through May 2015. Red dashed line is
the occurrence time of the 2014 $M_w$ 6.0 South Napa earthquake. Blue dashed lines
indicate the 95th percentile range of $dv/v$ distribution obtained from the time
interval 1 September 2010 through 23 August 2014.
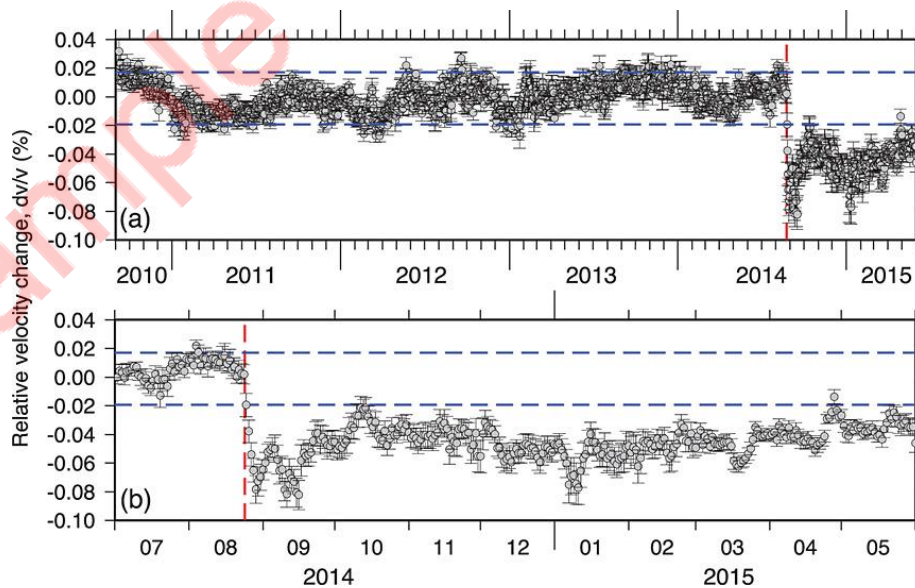


In order to develop a machine learning-based prediction model, how do standard
deviation and 95th percentile range help?

5   Consider the two-dimensional fluid flow patterns                                6

(2, 1), (3, 5), (4, 3), (5, 6), (6, 7), (7, 8)

Compute the principal component using PCA Algorithm.

6   Consider the training examples shown in following table below for a binary        6
classification problem.

| Instances | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | Target class (condition of bearing) |
|-----------|-----------|-----------|-----------|-------------------------------------|
| 1 | T | T | 1 | Cage fault |
| 2 | T | T | 6 | Cage fault |
| 3 | T | F | 5 | Ball fault |
| 4 | F | F | 4 | Cage fault |
| 5 | F | T | 7 | Ball fault |
| 6 | F | T | 3 | Ball fault |
| 7 | F | F | 8 | Ball fault |
| 8 | T | F | 7 | Cage fault |
| 9 | F | T | 5 | Ball fault |

a.  What are the information gains of $\alpha_1$ and $\alpha_2$ relative to these training examples?

b.  For $\alpha_3$ which is a continuous attribute, compute the information gain for every possible split.

c.  What is the best split (among $\alpha_1$, $\alpha_2$ and $\alpha_3$) according to the information gain?

*******************