Almustaqbal University
Engineering And Technical Engineering
Computer Techniques Engineering Department

Information Theory Laboratory

Class :- 4^{th}

Lectuer 3

Entropy Rate

By

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Experiment No. 1 " Entropy Rate "

Entropy rate is a measure of the **amount of information produced by a source per unit time**.

It shows how fast the source generates information and combines both **the source entropy** and **the average event duration**.

It is given by:-

$$H_r = \frac{H(X)}{T_{avg}}$$

$$H(X) = \sum P_i log_2 P_i$$

where:-

- H_r : Entropy Rate.
- $H(X)$: Source entropy (bits/symbol).
- T_{avg} : Average time per event.

Experiment No. 1 " Entropy Rate "

Objective :-

The purpose of this experiment is to calculate the entropy rate (Hr) of an information source, which represents the amount of information produced per unit time.
This is done by finding the source entropy H(X) and the average event time Tavg, and then computing the entropy rate

Procedure:-

- Input the probabilities of all source events: .... **px = [0.25 0.1 0.15 0.5];**
- Input the time period of each event: ……..... **tt = [3 4 5 4];**
- Calculate the **source entropy**: …… **Hx = -sum(px .* log2(px));**
- Calculate the average time of events: ……..**Tavg = sum(px .* tt);**
- Compute the entropy rate: ……**Hr = Hx / Tavg;**

Experiment No. 1 “ Entropy Rate ”

MATLAB code

```
px = [0.25 0.1 0.15 0.5]
tt = [3 4 5 4]
hx = -sum(px .* log2(px))
tx = sum(tt .* px)
Hr = hx / tx
```

Result

```
px = 0.25    0.1    0.15    0.5

tt = 3     4     5     4

hx = 1.7427

tx = 3.9000

Hr = 0.4469
```