

Experiment No. 4

Problem Statement:

Write a program to calculate harmonic mean (F-measure) and E-measure for the above example.

Objectives

1. To evaluate the retrieval performance of IR systems.
2. To understand importance of harmonic mean & E-measure in IR.
3. To study indexing structures for information retrieval.

Theory:

(F-score, F-measure)

F1 score considers both precision & recall.

It is a harmonic mean of the precision & recall.

F1 score is the best if there is some sort of balance between precision (P) & recall (R) in the system.

For example:

$$F_1 = \frac{2 \times \text{precision} \times \text{recall}}{\text{precision} + \text{Recall}}$$

Information systems can be measured with two metrics:

$P@R$ framing

precision and recall. Thus, precision and have been extensively used to evaluate retrieval performance of IR systems algorithms.

Alternative measures: The harmonic mean / F measure

The F-measure is also a single measure that combines recall & precision.

Where,
 $r(j)$ is the recall at the j^{th} position in the ranking.
 $p(j)$ is the precision at the j^{th} position in the ranking.
 $f(j)$ is the harmonic mean at the j^{th} position in the ranking.

Alternative measures: E-measure
E measure was proposed by Van Rijesbergh which combines recall & precision. User is allowed to specify whether he is more interested in recall or in precision.
E measure is defined as,

$$E(j) = 1 - \frac{1+b^2}{r(j) + b^2 p(j)}$$

where,
 $r(j)$ is the recall at the j -th position in J_1
the ranking.
 $p(j)$ is the precision at the j -th position in J_2
the ranking
 $b > 0$ is a user specified parameter.
 $E(j)$ is the user specified parameter.

If $b=1$ $E(j)$ measure works as complement to
of the Harmonic mean $F(j)$. If $b \geq 1$ indicates
that the user is more interested in precision
than in recall. If $b \leq 1$ indicates that
user is more interested in recall than
in precision. Notice that setting $b=1$
in the formula of the E -measure yields
 $F(j) = 1 \cdot E(j)$.

To calculate the Harmonic mean (F -measure)
and E -measure in Java, we need to
focus on the definitions.

$$1. \text{Precision} = \frac{\text{True Positive (TP)}}{\text{True positive (TP)} + \text{False positive (FP)}}$$

$$2. \text{Recall} = \frac{\text{True Positive (TP)}}{\text{True positive (TP)} + \text{False Negative (FN)}}$$

Formulas:

$$\bullet \text{ F-measure: } F_1 = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$

$$\bullet \text{ F-measure using } F_1 = \frac{1 - \alpha}{\alpha + \frac{1}{\text{precision}} + (1 - \alpha) \times \frac{1}{\text{Recall}}}$$

~~Implementation~~ is concluded by executing a program to calculate (F₁ measure) and F₁ measure. For sample input we have

(B)

$$(P) = 1 = (R)$$

$$(P) \text{ positive sum} = \text{positive sum}$$

$$(P) \text{ positive sum} + (N) \text{ positive sum}$$

$$(P) \text{ positive sum} = 100 \cdot 8 = 800$$

$$(P) \text{ positive sum} + (N) \text{ positive sum}$$