FIG. 1

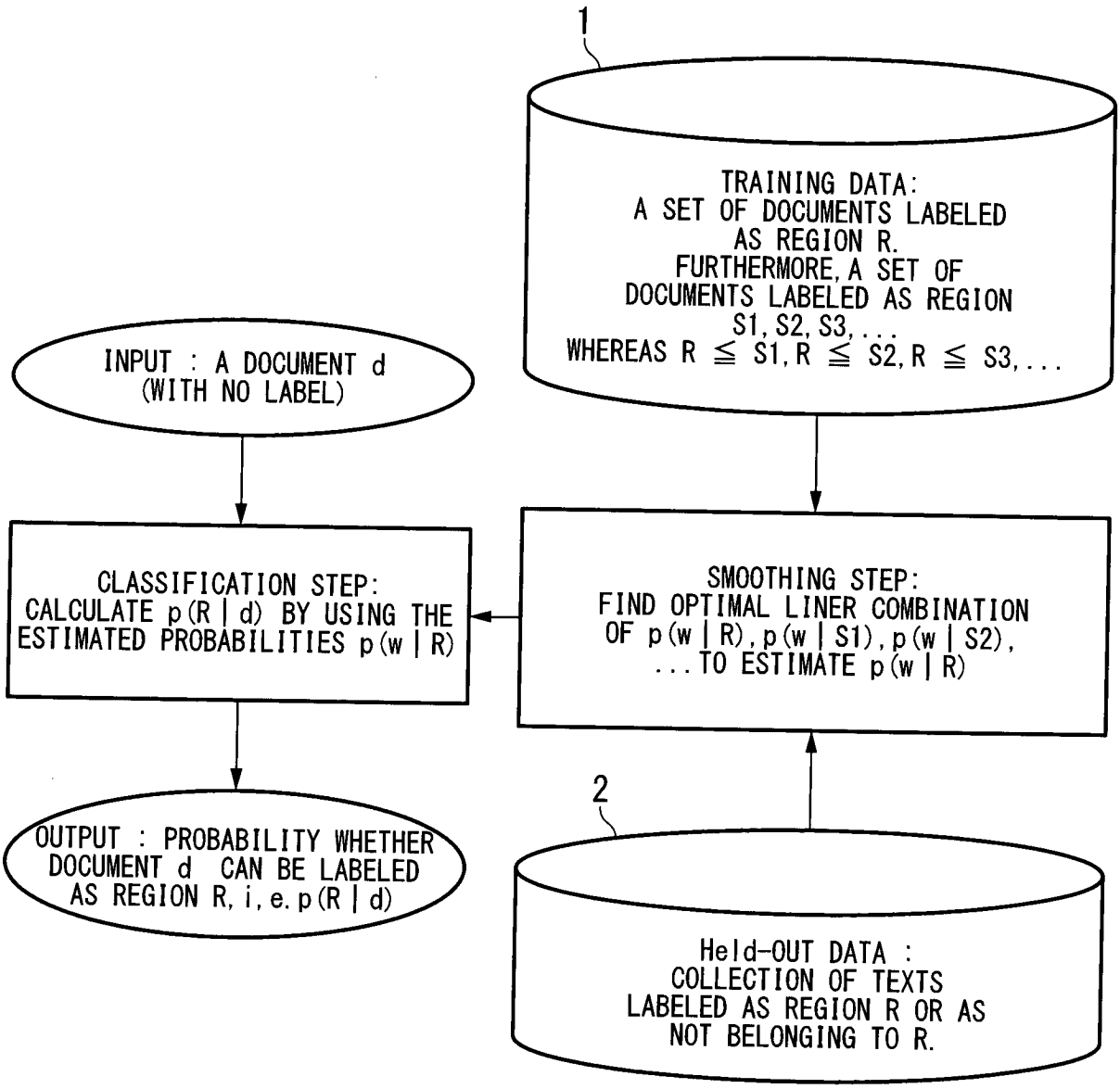

1
TRAINING DATA:
A SET OF DOCUMENTS LABELED AS REGION R.
FURTHERMORE, A SET OF DOCUMENTS LABELED AS REGION S1, S2, S3, ...
WHEREAS R ≦ S1, R ≦ S2, R ≦ S3, ...
INPUT : A DOCUMENT d (WITH NO LABEL)
CLASSIFICATION STEP:
CALCULATE p(R | d) BY USING THE ESTIMATED PROBABILITIES p(w | R)
SMOOTHING STEP:
FIND OPTIMAL LINER COMBINATION OF p(w | R), p(w | S1), p(w | S2), ... TO ESTIMATE p(w | R)
OUTPUT : PROBABILITY WHETHER DOCUMENT d CAN BE LABELED AS REGION R, i.e. p(R | d)
2
Held-OUT DATA :
COLLECTION OF TEXTS LABELED AS REGION R OR AS NOT BELONGING TO R.

FIG. 2

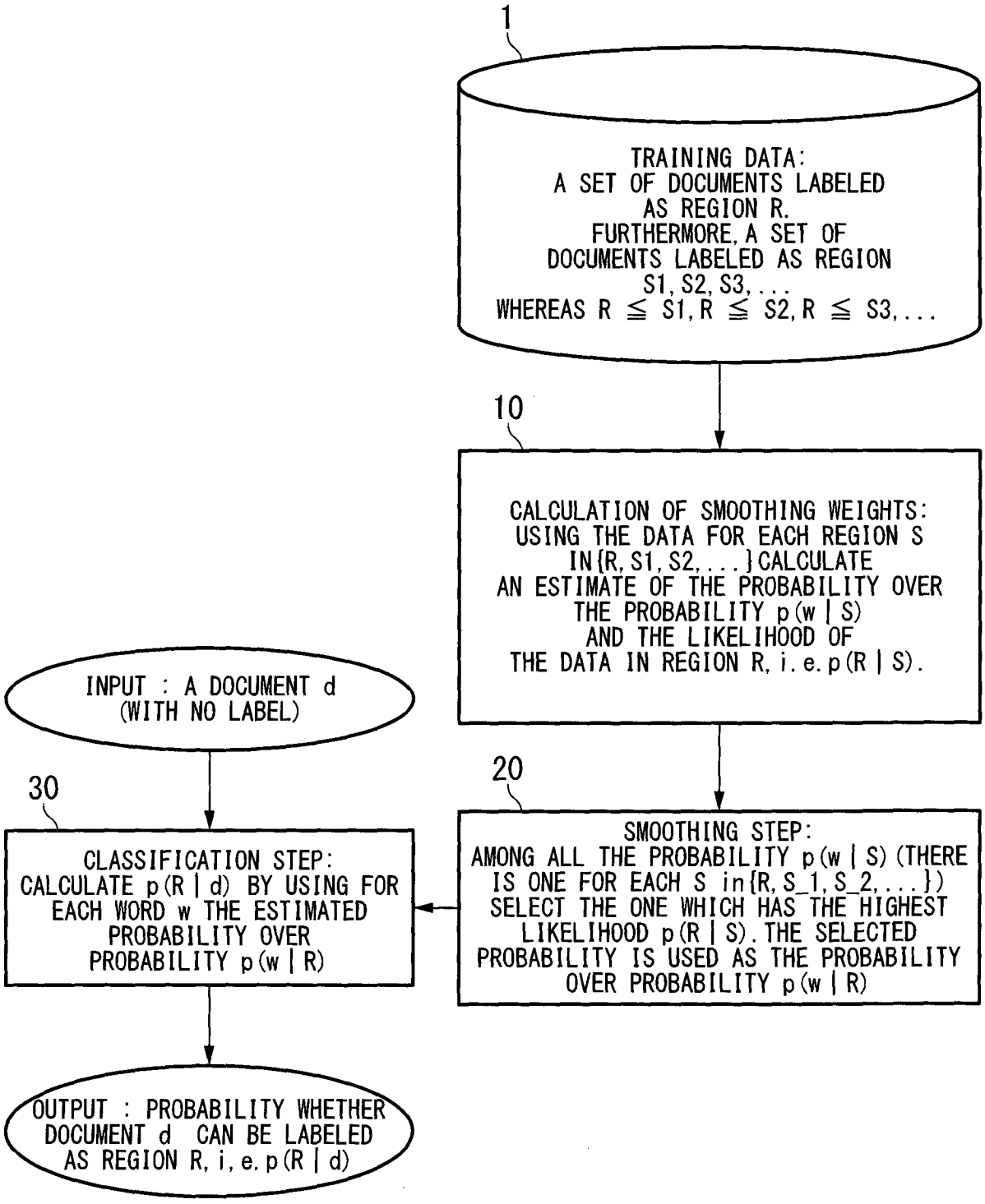

1
TRAINING DATA:
A SET OF DOCUMENTS LABELED AS REGION R.
FURTHERMORE, A SET OF DOCUMENTS LABELED AS REGION S1, S2, S3, ...
WHEREAS R ≦ S1, R ≦ S2, R ≦ S3, ...
10
CALCULATION OF SMOOTHING WEIGHTS:
USING THE DATA FOR EACH REGION S IN {R, S1, S2, ...} CALCULATE AN ESTIMATE OF THE PROBABILITY OVER THE PROBABILITY p(w | S) AND THE LIKELIHOOD OF THE DATA IN REGION R, i.e. p(R | S).
INPUT : A DOCUMENT d (WITH NO LABEL)
20
SMOOTHING STEP:
AMONG ALL THE PROBABILITY p(w | S) (THERE IS ONE FOR EACH S in {R, S_1, S_2, ...}) SELECT THE ONE WHICH HAS THE HIGHEST LIKELIHOOD p(R | S). THE SELECTED PROBABILITY IS USED AS THE PROBABILITY OVER PROBABILITY p(w | R)
30
CLASSIFICATION STEP:
CALCULATE p(R | d) BY USING FOR EACH WORD w THE ESTIMATED PROBABILITY OVER PROBABILITY p(w | R)
OUTPUT : PROBABILITY WHETHER DOCUMENT d CAN BE LABELED AS REGION R, i, e. p(R | d)

FIG. 3

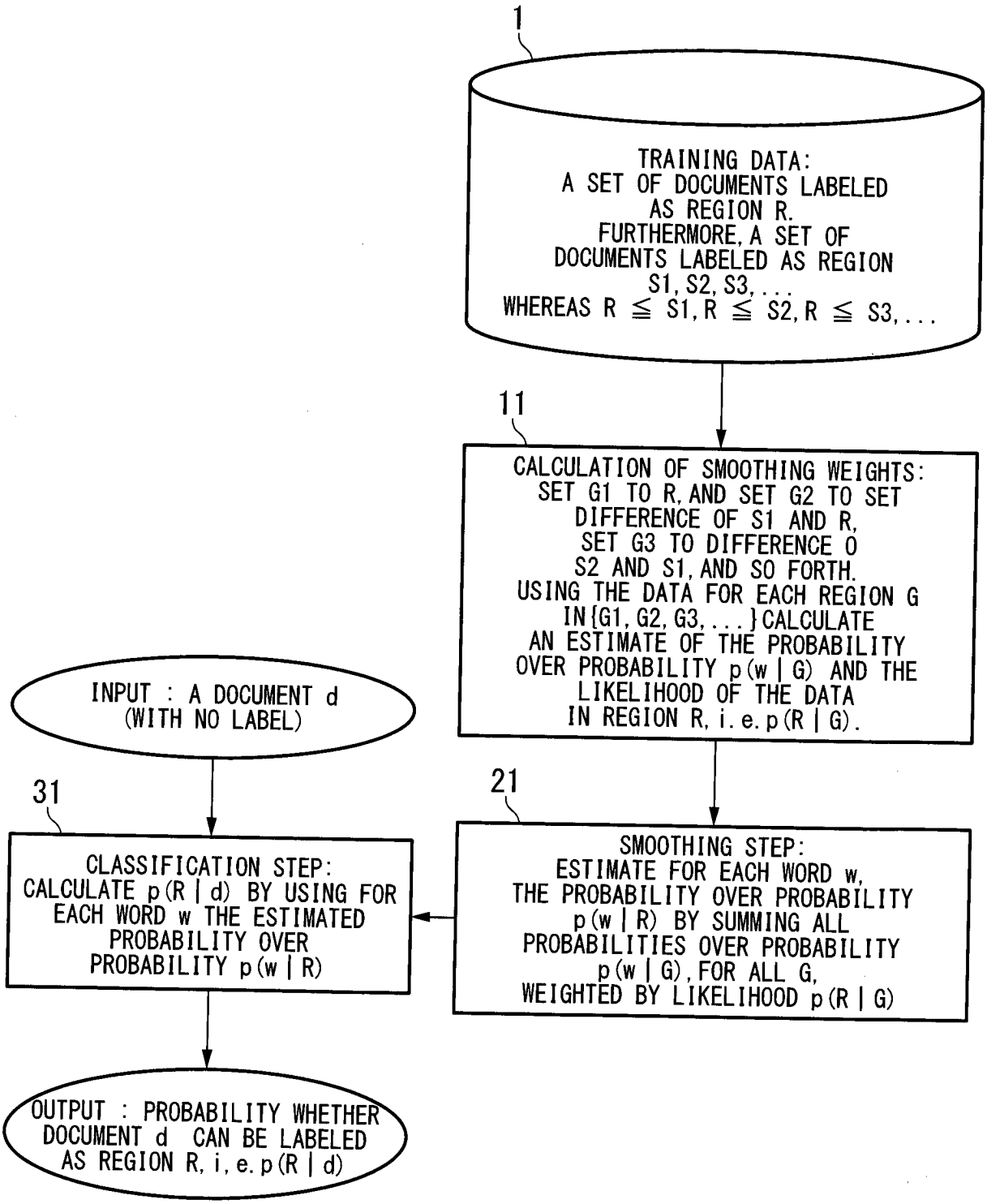

1
TRAINING DATA:
A SET OF DOCUMENTS LABELED AS REGION R.
FURTHERMORE, A SET OF DOCUMENTS LABELED AS REGION S1, S2, S3, . . .
WHEREAS R ≦ S1, R ≦ S2, R ≦ S3, . . .
11
CALCULATION OF SMOOTHING WEIGHTS:
SET G1 TO R, AND SET G2 TO SET DIFFERENCE OF S1 AND R,
SET G3 TO DIFFERENCE O S2 AND S1, AND SO FORTH.
USING THE DATA FOR EACH REGION G IN {G1, G2, G3, . . . } CALCULATE AN ESTIMATE OF THE PROBABILITY OVER PROBABILITY p(w | G) AND THE LIKELIHOOD OF THE DATA IN REGION R, i.e. p(R | G).
21
SMOOTHING STEP:
ESTIMATE FOR EACH WORD w, THE PROBABILITY OVER PROBABILITY p(w | R) BY SUMMING ALL PROBABILITIES OVER PROBABILITY p(w | G), FOR ALL G, WEIGHTED BY LIKELIHOOD p(R | G)
31
CLASSIFICATION STEP:
CALCULATE p(R | d) BY USING FOR EACH WORD w THE ESTIMATED PROBABILITY OVER PROBABILITY p(w | R)
INPUT : A DOCUMENT d (WITH NO LABEL)
OUTPUT : PROBABILITY WHETHER DOCUMENT d CAN BE LABELED AS REGION R, i, e. p(R | d)

FIG. 4

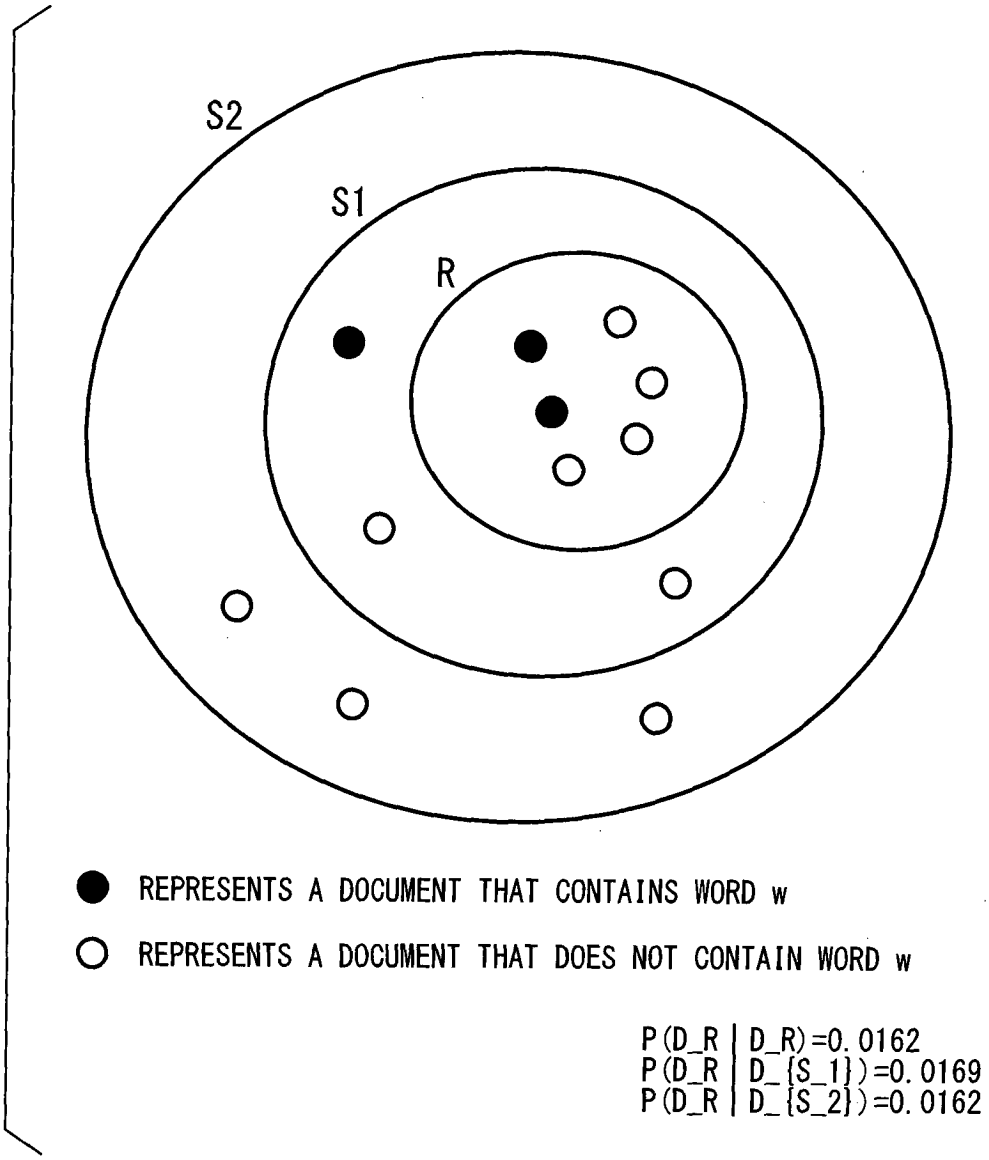
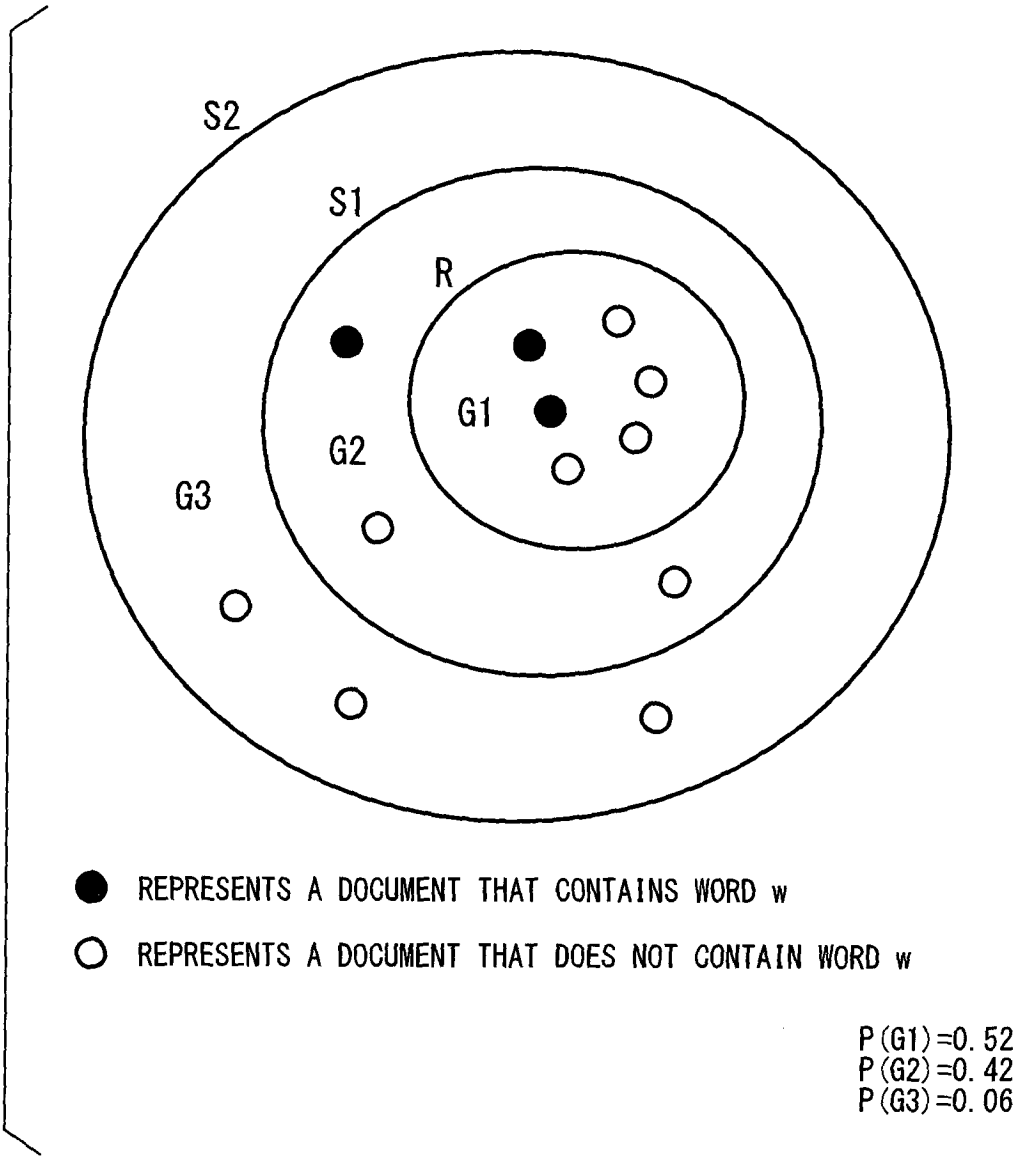

S2
S1
R
● REPRESENTS A DOCUMENT THAT CONTAINS WORD w
○ REPRESENTS A DOCUMENT THAT DOES NOT CONTAIN WORD w
P(D_R | D_R)=0.0162
P(D_R | D_{S_1})=0.0169
P(D_R | D_{S_2})=0.0162

FIG. 5


S2
S1
R
G1
G2
G3
● REPRESENTS A DOCUMENT THAT CONTAINS WORD w
○ REPRESENTS A DOCUMENT THAT DOES NOT CONTAIN WORD w
P(G1)=0.52
P(G2)=0.42
P(G3)=0.06