**CHARACTER RECOGNITION USING BACK PROPAGATION ALGORITHM**

**Group-4**

**SOURCE-CODE:**

**public** **class** BackPropogation {

**int**[] inputUnits = **new** **int**[35];

**double**[] outputUnits = **new** **double**[10];

**double**[] hiddenUnits = **new** **double**[10];

**double**[][] inputWeights = **new** **double**[inputUnits.length][10];

**double**[][] hiddenWeights = **new** **double**[10][outputUnits.length];

**double**[] deltaOfOutputUnit = **new** **double**[10];

**double**[] deltaOfHiddenUnit = **new** **double**[10];

**double** lc = 0.45;

**double** e = 2.7182;

**int** count = 0;

**int**[][] array = **new** **int**[5][35];

**int**[] targetA = {1,0,0,0,0,0,0,0,0,0};

**int**[] targetB = {0,1,0,0,0,0,0,0,0,0};

**int**[] targetC = {0,0,1,0,0,0,0,0,0,0};

**int**[] targetD = {0,0,0,1,0,0,0,0,0,0};

**int**[] targetE = {0,0,0,0,1,0,0,0,0,0};

**int**[] targetF = {0,0,0,0,0,1,0,0,0,0};

**int**[] targetG = {0,0,0,0,0,0,1,0,0,0};

**int**[] targetH = {0,0,0,0,0,0,0,1,0,0};

**int**[] targetI = {0,0,0,0,0,0,0,0,1,0};

**int**[] targetJ = {0,0,0,0,0,0,0,0,0,1};

**int**[] array1 = {0,0,0,0,0,0,0,1,0,0,0,1,0,1,0,0,1,0,1,0,0,1,1,1,0,1,0,0,0,1,1,0,0,0,1};

**int**[] array2 = {0,0,0,0,0,0,1,1,1,0,1,1,0,1,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1};

**int**[] array3 = {0,0,1,0,0,0,1,0,1,0,1,1,0,1,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1};

**int**[] array4 = {0,0,0,0,0,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1};

**int**[] array5 = {0,0,1,0,0,0,0,1,0,0,0,1,0,1,0,0,1,1,1,0,0,1,0,1,0,1,0,0,0,1,1,0,0,0,1};

**int**[] array6 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,0,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array7 = {0,1,1,1,0,1,0,0,0,1,1,0,0,0,1,1,1,1,1,0,1,0,0,0,1,1,0,0,0,1,0,1,1,1,0};

**int**[] array8 = {1,1,1,1,0,1,0,0,0,1,1,0,0,0,1,1,1,1,1,0,1,0,0,0,1,1,0,0,0,1,1,1,1,1,0};

**int**[] array9 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array10 = {1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1,1,1,1,0};

**int**[] array11 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1};

**int**[] array12 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,1,1,1,1};

**int**[] array13 = {0,1,1,1,0,1,0,0,0,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,0,1,1,1,0};

**int**[] array14 = {0,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,0,1,1,1,1};

**int**[] array15 = {0,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,0,1,1,1,1};

**int**[] array16 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array17 = {1,1,1,1,0,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,0};

**int**[] array18 = {1,1,1,0,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,1,1,0,0};

**int**[] array19 = {1,1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,1,1,1,1,1};

**int**[] array20 = {1,1,1,1,0,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,1,1,1,1,0};

**int**[] array21 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1};

**int**[] array22 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,1,1,1,1,1,1};

**int**[] array23 = {1,1,1,1,0,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,0};

**int**[] array24 = {1,1,1,1,0,1,0,0,1,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,1,0,1,1,1,1,0};

**int**[] array25 = {0,1,1,1,0,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,0,1,1,1,0};

**int**[] array26 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] array27 = {0,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] array28 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] array29 = {0,1,1,1,0,1,0,0,0,1,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] array30 = {1,1,1,1,0,1,0,0,1,0,1,0,0,0,0,1,1,1,1,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] array31 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array32 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,0,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array33 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,0,1,1,1,1,0,1,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array34 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,1,1,1,1,0,1,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array35 = {0,1,1,1,0,1,0,0,0,1,1,0,0,0,0,1,0,1,1,0,1,0,1,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] array36 = {1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1};

**int**[] array37 = {0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,1,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0};

**int**[] array38 = {1,1,0,1,1,0,1,0,1,0,0,1,0,1,0,0,1,1,1,0,0,1,0,1,0,0,1,0,1,0,1,1,0,1,1};

**int**[] array39 = {1,1,0,1,1,1,1,0,1,1,0,1,0,1,0,0,1,1,1,0,0,1,0,1,0,1,1,0,1,1,1,1,0,1,1};

**int**[] array40 = {0,1,0,1,0,1,1,0,1,1,0,1,0,1,0,0,1,1,1,0,0,1,0,1,0,1,1,0,1,1,0,1,0,1,0};

**int**[] array41 = {1,1,1,1,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,1,1,1,1,1};

**int**[] array42 = {1,1,1,1,1,1,0,1,0,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,1,0,1,0,1,1,1,1,1,1};

**int**[] array43 = {0,1,1,1,0,1,0,1,0,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,1,0,1,0,1,0,1,1,1,0};

**int**[] array44 = {0,1,1,1,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,1,0};

**int**[] array45 = {0,1,1,1,0,0,1,1,1,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,1,0,0,1,1,1,0};

**int**[] array46 = {1,1,1,1,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0};

**int**[] array47 = {1,1,1,1,1,1,0,1,0,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0,0,1,1,0,0};

**int**[] array48 = {1,1,1,1,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0,0,1,1,0,0};

**int**[] array49 = {1,1,1,1,1,1,0,1,0,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0};

**int**[] array50 = {0,1,1,1,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0};

**int**[] testArray1 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1};

**int**[] testArray2 = {0,1,1,1,0,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1};

**int**[] testArray3 = {0,0,1,0,0,0,1,0,1,0,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1};

**int**[] testArray4 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] testArray5 = {0,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,0,1,1,1,0};

**int**[] testArray6 = {0,1,1,1,0,0,1,0,0,1,0,1,0,0,1,0,1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1,1,1,0};

**int**[] testArray7 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1};

**int**[] testArray8 = {0,1,1,1,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,0,1,1,1,0};

**int**[] testArray9 = {1,1,1,1,0,1,0,0,1,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,1,0,1,1,1,1,0};

**int**[] testArray10 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] testArray11 = {0,1,1,1,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,1,1,1};

**int**[] testArray12 = {1,1,1,1,1,1,1,0,0,1,0,1,0,0,1,0,1,0,0,1,0,1,0,0,1,1,1,0,0,1,1,1,1,1,1};

**int**[] testArray13 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1};

**int**[] testArray14 = {0,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,0,1,1,1,1};

**int**[] testArray15 = {0,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,1,0,1,1,1,1};

**int**[] testArray16 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] testArray17 = {0,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] testArray18 = {0,1,1,1,0,1,0,0,1,0,1,0,0,0,0,1,1,1,1,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0};

**int**[] testArray19 = {1,1,1,1,1,1,0,0,0,0,1,0,0,0,0,1,0,1,1,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1};

**int**[] testArray20 = {0,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,0,1,1,1,1,0,0,0,1,1,0,0,0,1,0,1,1,1,1};

**int**[] testArray21 = {1,1,1,1,1,1,0,0,0,1,1,0,0,0,0,1,0,1,1,0,1,0,1,0,1,1,0,0,0,1,0,1,1,1,0};

**int**[] testArray22 = {1,0,0,0,1,1,0,0,0,1,1,0,0,0,1,1,1,1,1,1,1,0,0,0,1,1,0,0,0,1,1,0,0,0,1};

**int**[] testArray23 = {1,0,0,0,1,1,1,0,1,1,0,1,0,1,0,0,1,1,1,0,0,1,0,1,0,1,1,0,1,1,1,0,0,0,1};

**int**[] testArray24 = {0,0,0,0,0,0,1,0,1,0,0,1,0,1,0,0,1,1,1,0,0,1,0,1,0,0,1,0,1,0,0,0,0,0,0};

**int**[] testArray25 = {1,1,1,1,1,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,1,1,1,1,1};

**int**[] testArray26 = {0,0,0,0,0,0,1,1,1,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,1,0,0,0,0,0,0};

**int**[] testArray27 = {0,0,0,0,0,0,1,1,1,0,0,1,1,1,0,0,0,1,0,0,0,1,1,1,0,0,1,1,1,0,0,0,0,0,0};

**int**[] testArray28 = {0,1,1,1,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0};

**int**[] testArray29 = {0,1,1,1,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0,0,1,1,0,0};

**int**[] testArray30 = {0,1,1,1,0,0,1,1,1,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,0,1,0,0,0,1,1,0,0};

**public** **void** randomWeights() {

//System.out.println("The randomly generated Input Weights are: ");

**for** (**int** i = 0; i < inputWeights.length; i++) {

**for** (**int** j = 0; j < inputWeights[i].length; j++) {

inputWeights[i][j] = (**double**) (Math.*random*() \* (1-(-1))-1);

//System.out.println(String.format("%.2f", inputWeights[i][j]));

}

}

//System.out.println("The randomly generated Hidden Weights are: ");

**for** (**int** i = 0; i < hiddenWeights.length; i++) {

**for** (**int** j = 0; j < hiddenWeights[i].length; j++) {

hiddenWeights[i][j] = (**double**) (Math.*random*() \* (1-(-1))-1);

//System.out.println(String.format("%.2f", hiddenWeights[i][j]));

}

}

}

**public** **void** backPropagation()

{

randomWeights();

**boolean** loop = **false**;

**while**(loop = **false**){

**for**(**int** x = 0; x<50; x++)

{

//System.out.println("----------------- Feed Forward Step -----------------");

**if**(x==0)

System.*arraycopy*(array1, 0, inputUnits, 0, inputUnits.length);

**if**(x==1)

System.*arraycopy*(array2, 0, inputUnits, 0, inputUnits.length);

**if**(x==2)

System.*arraycopy*(array3, 0, inputUnits, 0, inputUnits.length);

**if**(x==3)

System.*arraycopy*(array4, 0, inputUnits, 0, inputUnits.length);

**if**(x==4)

System.*arraycopy*(array5, 0, inputUnits, 0, inputUnits.length);

**if**(x==5)

System.*arraycopy*(array6, 0, inputUnits, 0, inputUnits.length);

**if**(x==6)

System.*arraycopy*(array7, 0, inputUnits, 0, inputUnits.length);

**if**(x==7)

System.*arraycopy*(array8, 0, inputUnits, 0, inputUnits.length);

**if**(x==8)

System.*arraycopy*(array9, 0, inputUnits, 0, inputUnits.length);

**if**(x==9)

System.*arraycopy*(array10, 0, inputUnits, 0, inputUnits.length);

**if**(x==10)

System.*arraycopy*(array11, 0, inputUnits, 0, inputUnits.length);

**if**(x==11)

System.*arraycopy*(array12, 0, inputUnits, 0, inputUnits.length);

**if**(x==12)

System.*arraycopy*(array13, 0, inputUnits, 0, inputUnits.length);

**if**(x==13)

System.*arraycopy*(array14, 0, inputUnits, 0, inputUnits.length);

**if**(x==14)

System.*arraycopy*(array15, 0, inputUnits, 0, inputUnits.length);

**if**(x==15)

System.*arraycopy*(array16, 0, inputUnits, 0, inputUnits.length);

**if**(x==16)

System.*arraycopy*(array17, 0, inputUnits, 0, inputUnits.length);

**if**(x==17)

System.*arraycopy*(array18, 0, inputUnits, 0, inputUnits.length);

**if**(x==18)

System.*arraycopy*(array19, 0, inputUnits, 0, inputUnits.length);

**if**(x==19)

System.*arraycopy*(array20, 0, inputUnits, 0, inputUnits.length);

**if**(x==20)

System.*arraycopy*(array21, 0, inputUnits, 0, inputUnits.length);

**if**(x==21)

System.*arraycopy*(array22, 0, inputUnits, 0, inputUnits.length);

**if**(x==22)

System.*arraycopy*(array23, 0, inputUnits, 0, inputUnits.length);

**if**(x==23)

System.*arraycopy*(array24, 0, inputUnits, 0, inputUnits.length);

**if**(x==24)

System.*arraycopy*(array25, 0, inputUnits, 0, inputUnits.length);

**if**(x==25)

System.*arraycopy*(array26, 0, inputUnits, 0, inputUnits.length);

**if**(x==26)

System.*arraycopy*(array27, 0, inputUnits, 0, inputUnits.length);

**if**(x==27)

System.*arraycopy*(array28, 0, inputUnits, 0, inputUnits.length);

**if**(x==28)

System.*arraycopy*(array29, 0, inputUnits, 0, inputUnits.length);

**if**(x==29)

System.*arraycopy*(array30, 0, inputUnits, 0, inputUnits.length);

**if**(x==30)

System.*arraycopy*(array31, 0, inputUnits, 0, inputUnits.length);

**if**(x==31)

System.*arraycopy*(array32, 0, inputUnits, 0, inputUnits.length);

**if**(x==32)

System.*arraycopy*(array33, 0, inputUnits, 0, inputUnits.length);

**if**(x==33)

System.*arraycopy*(array34, 0, inputUnits, 0, inputUnits.length);

**if**(x==34)

System.*arraycopy*(array35, 0, inputUnits, 0, inputUnits.length);

**if**(x==35)

System.*arraycopy*(array36, 0, inputUnits, 0, inputUnits.length);

**if**(x==36)

System.*arraycopy*(array37, 0, inputUnits, 0, inputUnits.length);

**if**(x==37)

System.*arraycopy*(array38, 0, inputUnits, 0, inputUnits.length);

**if**(x==38)

System.*arraycopy*(array39, 0, inputUnits, 0, inputUnits.length);

**if**(x==39)

System.*arraycopy*(array40, 0, inputUnits, 0, inputUnits.length);

**if**(x==40)

System.*arraycopy*(array41, 0, inputUnits, 0, inputUnits.length);

**if**(x==41)

System.*arraycopy*(array42, 0, inputUnits, 0, inputUnits.length);

**if**(x==42)

System.*arraycopy*(array43, 0, inputUnits, 0, inputUnits.length);

**if**(x==43)

System.*arraycopy*(array44, 0, inputUnits, 0, inputUnits.length);

**if**(x==44)

System.*arraycopy*(array45, 0, inputUnits, 0, inputUnits.length);

**if**(x==45)

System.*arraycopy*(array46, 0, inputUnits, 0, inputUnits.length);

**if**(x==46)

System.*arraycopy*(array47, 0, inputUnits, 0, inputUnits.length);

**if**(x==47)

System.*arraycopy*(array48, 0, inputUnits, 0, inputUnits.length);

**if**(x==48)

System.*arraycopy*(array49, 0, inputUnits, 0, inputUnits.length);

**if**(x==49)

System.*arraycopy*(array50, 0, inputUnits, 0, inputUnits.length);

//System.out.println("The output of hidden units are:");

**for**(**int** i = 0; i< hiddenUnits.length;i++)

{

**for**(**int** j = 0; j< inputUnits.length;j++)

{

hiddenUnits[i] = hiddenUnits[i] + (inputUnits[i] \* inputWeights[j][i]);

}

hiddenUnits[i] = (1 / (1 + (Math.*pow*(e, -hiddenUnits[i]))));

//System.out.println("hiddenUnits "+String.format("%.2f", hiddenUnits[i]));

}

//System.out.println("");

//System.out.println("The output of output units are:");

**for**(**int** i = 0; i< hiddenUnits.length;i++)

{

**for**(**int** j = 0; j< outputUnits.length;j++)

{

outputUnits[i] = outputUnits[i] + (hiddenUnits[i] \* hiddenWeights[j][i]);

}

outputUnits[i] = (1 / (1 + (Math.*pow*(e, -outputUnits[i]))));

**if**(outputUnits[i] > 0.9) outputUnits[i] = 1.0;

**else** **if**(outputUnits[i]<0.1) outputUnits[i] = 0.0;

//System.out.println("outputUnits "+String.format("%.2f", outputUnits[i]));

}

//System.out.println("----------------- Backward Step -----------------");

**for**(**int** i = 0; i< hiddenUnits.length;i++)

{

**if**(i == 0) System.*arraycopy*(targetA, 0, targetA, 0, targetA.length);

**if**(i == 1) System.*arraycopy*(targetB, 0, targetA, 0, targetA.length);

**if**(i == 2) System.*arraycopy*(targetC, 0, targetA, 0, targetA.length);

**if**(i == 3) System.*arraycopy*(targetD, 0, targetA, 0, targetA.length);

**if**(i == 4) System.*arraycopy*(targetE, 0, targetA, 0, targetA.length);

**if**(i == 5) System.*arraycopy*(targetF, 0, targetA, 0, targetA.length);

**if**(i == 6) System.*arraycopy*(targetG, 0, targetA, 0, targetA.length);

**if**(i == 7) System.*arraycopy*(targetH, 0, targetA, 0, targetA.length);

**if**(i == 8) System.*arraycopy*(targetI, 0, targetA, 0, targetA.length);

**if**(i == 9) System.*arraycopy*(targetJ, 0, targetA, 0, targetA.length);

**if**(outputUnits[i] == targetA[i])

{

**if**(outputUnits[0] == targetA[1] && outputUnits[1] == targetA[1] && outputUnits[2] == targetA[2] &&outputUnits[3] == targetA[3] && outputUnits[4] == targetA[4]

&& outputUnits[5] == targetA[5] && outputUnits[6] == targetA[6] && outputUnits[7] == targetA[7] && outputUnits[8] == targetA[8] && outputUnits[9] == targetA[9])

{

System.***out***.println("");

System.***out***.println("Target output is "+outputUnits[i] +" same as the actual output "+targetA[i]);

System.***out***.println("This is the terminating condition");

loop = **true**;

}

}

**else**

{

**for**(**int** k = 0; k< outputUnits.length; k++)

{

deltaOfOutputUnit[k] = (targetA[k] - outputUnits[i]) \* outputUnits[i] \*(1.0 - outputUnits[i]);

**for**(**int** l = 0; l< hiddenUnits.length; l++)

{

hiddenWeights[k][l] = hiddenWeights[k][l] + (lc \* deltaOfOutputUnit[k] \* hiddenUnits[i]);

//System.out.println("updated hidden weights: "+ String.format("%.2f", hiddenWeights[k][l]));

}

}

**for**(**int** k = 0; k < hiddenWeights.length; k++)

{

**for**(**int** m =0; m<hiddenWeights[k].length; m++)

{

deltaOfHiddenUnit[k] = (deltaOfOutputUnit[k] \* hiddenWeights[k][k])\* hiddenUnits[i] \*(1-hiddenUnits[i]) ;

**for**(**int** l = 0; l< inputUnits.length; l++)

{

inputWeights[l][k] = inputWeights[l][k] +(lc \* deltaOfHiddenUnit[k] \* inputUnits[l]);

//System.out.println("updated input weights: "+ String.format("%.2f", inputWeights[l][k]));

}

}

}

}

}

}

}

}

**public** **void** testing()

{

**for**(**int** x = 0; x<30; x++)

{

**if**(x==0)

{

System.***out***.println("The output of 1st testing sample is:");

System.*arraycopy*(testArray1, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==1)

{

System.***out***.println("The output of 2nd testing sample is:");

System.*arraycopy*(testArray2, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==2)

{

System.***out***.println("The output of 3rd testing sample is:");

System.*arraycopy*(testArray3, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==3)

{

System.***out***.println("The output of 4th testing sample is:");

System.*arraycopy*(testArray4, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==4)

{

System.***out***.println("The output of 5th testing sample is:");

System.*arraycopy*(testArray5, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==5)

{

System.***out***.println("The output of 6th testing sample is:");

System.*arraycopy*(testArray6, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==6)

{

System.***out***.println("The output of 7th testing sample is:");

System.*arraycopy*(testArray7, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==7)

{

System.***out***.println("The output of 8th testing sample is:");

System.*arraycopy*(testArray8, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==8)

{

System.***out***.println("The output of 9th testing sample is:");

System.*arraycopy*(testArray9, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==9)

{

System.***out***.println("The output of 10th testing sample is:");

System.*arraycopy*(testArray10, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==10)

{

System.***out***.println("The output of 11th testing sample is:");

System.*arraycopy*(testArray11, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==11)

{

System.***out***.println("The output of 12th testing sample is:");

System.*arraycopy*(testArray12, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==12)

{

System.***out***.println("The output of 13rd testing sample is:");

System.*arraycopy*(testArray13, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==13)

{

System.***out***.println("The output of 14th testing sample is:");

System.*arraycopy*(testArray14, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==14)

{

System.***out***.println("The output of 15th testing sample is:");

System.*arraycopy*(testArray15, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==15)

{

System.***out***.println("The output of 16th testing sample is:");

System.*arraycopy*(testArray16, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==16)

{

System.***out***.println("The output of 17th testing sample is:");

System.*arraycopy*(testArray17, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==17)

{

System.***out***.println("The output of 18th testing sample is:");

System.*arraycopy*(testArray18, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==18)

{

System.***out***.println("The output of 19th testing sample is:");

System.*arraycopy*(testArray19, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==19)

{

System.***out***.println("The output of 20th testing sample is:");

System.*arraycopy*(testArray20, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==20)

{

System.***out***.println("The output of 21st testing sample is:");

System.*arraycopy*(testArray21, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==21)

{

System.***out***.println("The output of 22nd testing sample is:");

System.*arraycopy*(testArray22, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==22)

{

System.***out***.println("The output of 23rd testing sample is:");

System.*arraycopy*(testArray23, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==23)

{

System.***out***.println("The output of 24th testing sample is:");

System.*arraycopy*(testArray24, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==24)

{

System.***out***.println("The output of 25th testing sample is:");

System.*arraycopy*(testArray25, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==25)

{

System.***out***.println("The output of 26th testing sample is:");

System.*arraycopy*(testArray26, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==26)

{

System.***out***.println("The output of 27th testing sample is:");

System.*arraycopy*(testArray27, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==27)

{

System.***out***.println("The output of 28th testing sample is:");

System.*arraycopy*(testArray28, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==28)

{

System.***out***.println("The output of 29th testing sample is:");

System.*arraycopy*(testArray29, 0, inputUnits, 0, inputUnits.length);

}

**if**(x==29)

{

System.***out***.println("The output of 30th testing sample is:");

System.*arraycopy*(testArray30, 0, inputUnits, 0, inputUnits.length);

}

// System.out.println("The output of hidden units are:");

**for**(**int** i = 0; i< hiddenUnits.length;i++)

{

**for**(**int** j = 0; j< inputUnits.length;j++)

{

hiddenUnits[i] = hiddenUnits[i] + (inputUnits[i] \* inputWeights[j][i]);

}

hiddenUnits[i] = (1 / (1 + (Math.*pow*(e, -hiddenUnits[i]))));

//System.out.println("hiddenUnits "+String.format("%.2f", hiddenUnits[i]));

}

//System.out.println("The output of output units are:");

**for**(**int** i = 0; i< hiddenUnits.length;i++)

{

**for**(**int** j = 0; j< outputUnits.length;j++)

{

outputUnits[i] = outputUnits[i] + (hiddenUnits[i] \* hiddenWeights[j][i]);

}

outputUnits[i] = (1 / (1 + (Math.*pow*(e, -outputUnits[i]))));

**if**(outputUnits[i] > 0.9) outputUnits[i] = 1.0;

**else** **if**(outputUnits[i]<0.1) outputUnits[i] = 0.0;

System.***out***.printf(String.*format*("%.1f", outputUnits[i])+" ");

}

System.***out***.println("");

}

}

**public** **static** **void** main(String[] args) {

// **TODO** code application logic here

BackPropogation cr = **new** BackPropogation();

cr.backPropagation();

cr.testing();

}

}

**OUTPUT:**

The output of 1st testing sample is:

0.5 0.6 0.3 0.5 0.8 0.6 0.8 0.6 0.3 0.2

The output of 2nd testing sample is:

0.3 0.7 0.4 0.6 1.0 0.8 1.0 0.8 0.2 0.2

The output of 3rd testing sample is:

0.2 1.0 0.4 0.8 1.0 0.8 1.0 0.8 0.1 0.2

The output of 4th testing sample is:

0.5 0.8 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 5th testing sample is:

0.3 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.1 0.2

The output of 6th testing sample is:

0.2 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 7th testing sample is:

0.5 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 8th testing sample is:

0.3 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 9th testing sample is:

0.6 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.1 0.2

The output of 10th testing sample is:

0.6 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 11th testing sample is:

0.3 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 12th testing sample is:

0.6 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 13rd testing sample is:

0.6 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 14th testing sample is:

0.3 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 15th testing sample is:

0.2 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 16th testing sample is:

0.5 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 17th testing sample is:

0.3 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 18th testing sample is:

0.2 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.1 0.2

The output of 19th testing sample is:

0.5 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 20th testing sample is:

0.3 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 21st testing sample is:

0.6 0.7 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 22nd testing sample is:

0.6 1.0 0.5 0.8 1.0 0.8 1.0 0.8 0.2 0.2

The output of 23rd testing sample is:

0.6 1.0 0.5 0.8 1.0 0.8 1.0 0.8 0.1 0.2

The output of 24th testing sample is:

0.3 1.0 0.5 0.8 1.0 0.8 1.0 0.8 0.1 0.2

The output of 25th testing sample is:

0.6 0.8 0.4 0.7 1.0 0.8 1.0 0.8 0.2 0.2

The output of 26th testing sample is:

0.3 1.0 0.5 0.8 1.0 0.8 1.0 0.7 0.1 0.2

The output of 27th testing sample is:

0.2 1.0 0.5 0.8 1.0 0.8 1.0 0.7 0.1 0.2

The output of 28th testing sample is:

0.2 0.8 0.4 0.7 1.0 0.8 1.0 0.7 0.2 0.2

The output of 29th testing sample is:

0.2 0.8 0.4 0.7 1.0 0.8 1.0 0.7 0.2 0.2

The output of 30th testing sample is:

0.2 0.7 0.4 0.7 1.0 0.8 1.0 0.7 0.1 0.2