FFR135, Artificial Neural Networks

Home Problem 1

One-step error probability

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1 One-step error probability

1.1 One-step error probability

```
clear
clc
numberOfTrials = 1000;
numberBits = 120;
p=[12,24,48,70,100,120];
%diagElements=0; %if diagonal = 0
diagElements=1; %if diagonal is not = 0
for j=1:6
    errorOccured = 0;
    for n=1:numberOfTrials
    numberPatterns = p(j);
    patterns=GeneratePatterns(numberBits,numberPatterns);
    w=WeightMatrix(patterns,diagElements);

    chosenPattern=datasample(patterns,1,2);

    randPattern=randi([1 120],1);

    newState=sign(sum(w.*chosenPattern));
    newState=transpose(newState);

    if newState(randPattern) ~= chosenPattern(randPattern)
        errorOccured = errorOccured+1;

    end
    end
    errorProbability (j) = errorOccured/numberOfTrials
end
```

1.2 Weight Matrix

```
function weightMatrix=WeightMatrix(patterns,diagElements)

sizePattern=size(patterns);
numberBits = sizePattern(1);
weightMatrix=0;

for j=1:numberBits
    for i=1:numberBits
    weightMatrix(i,j)=sum(patterns(i,:).*patterns(j,:));
    end
end
if diagElements==0
  weightMatrix = (1/(numberBits).*(weightMatrix-eye(numberBits).*↩
      weightMatrix(1,1)));
else
    weightMatrix = 1/(numberBits).*weightMatrix;
end

end
```

1.3 Generate Patterns

```
function randPatterns=GeneratePatterns(numberBits,numberPatterns)
randPatterns=rand(numberBits,numberPatterns);
randPatterns=sign(randPatterns-0.5*ones(numberBits,numberPatterns));

end
```