June 3, 2021 Meeting Agenda

June 11, 2021

1 Gaussian EM Algorithm

I finished implementing the Gaussian EM algorithm, but I think I might have made a mistake because our estimates for all of the parameters seem to just go to infinity. The section below contains the pseudocode of how I implemented it.

1.1 Pseudocode

Algorithm 1: Ad-hoc Algorithm

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   input : InitialMuX, InitialSigmaX, InitialMuD, InitialSigmaD, tolerance
   output: MuX,SigmaX,MuD,SigmaD
   pleas = GetCleanDayPleas();
   prevMuX, prevSigmaX = (0,0);
   prevMuD, prevSigmaD = (0,0);
   MuX, SigmaX = (InitialMuX, InitialSigmaX);
   MuD, SigmaD = (InitialMuD, InitialSigmaD);
   prevTheta = [InitialMuX, InitialSigmaX, InitialMuD, InitialSigmaD];
   theta = [MuX, SigmaX, MuD, SigmaD];
   while $(|theta - prevTheta|_\infty > tolerance)$ **do**
       prevMuX, prevSigmaX = MuX, SigmaX;
       prevMuD, prevSigmaD = MuD, SigmaD;
       prevTheta = [prevMuX, prevSigmaX, prevMuD, prevSigmaD];
       MuX = UpdateMu(prevMuX,prevSigmaX,pleas);
       SigmaX = UpdateSigma(prevMuX,prevSigmaX,pleas);
       MuD = UpdateMu(prevMuD,prevSigmaD,pleas);
       SigmaD = UpdateSigma(prevMuD,prevSigmaD,pleas);
       theta = [MuX, SigmaX, MuD, SigmaD];
   end

Algorithm 2: UpdateMu

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input : Mu, Sigma, Pleas
output: NewMu
n = length(Pleas);
x1 = [];
for *s in Pleas* **do**
    tempX1 = CalculateX1(Mu,Sigma,s);
    x1.append(tempX1);
end
Summation = sum(x1 + pleas);
NewMu = Summation/(2n);

Algorithm 3: UpdateSigma

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input : Mu, Sigma, Pleas
output: NewSigma
n = length(Pleas);
x1 = [];
for *s in Pleas* **do**
    tempX1 = CalculateX1(Mu,Sigma,s);
    x1.append(tempX1);
end
x2 = [];
for *s in Pleas* **do**
    tempX2 = CalculateX2(Mu,Sigma,s);
    x2.append(tempX2);
end
$FirstTerm = sum(x1 + pleas^2)/(2n)$ $SecondTerm = (sum(x1 + pleas)/(2n))^2$ $NewSigma = SquareRoot(FirstTerm - SecondTerm)$

Algorithm 4: CalculateX1

---

input : Mu, Sigma, s
output: x1
y = (s-Mu)/Sigma;
FirstTerm = Sigma/(1-NormalCDF(y));
SecondTerm = NormalPDF(y);
x1 = Mu + FirstTerm*SecondTerm;

Algorithm 5: CalculateX2

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input : Mu, Sigma, s
output: x2
y = (s-Mu)/Sigma;
FirstTerm = ((Mu*Sigma)/(1-NormalCDF(y)))*NormalPDF(y);
SecondTerm = ((Sigma*Sigma)/(1-NormalCDF(y)))*NormalPDF(y)*s;
$x2 = Mu^2 + Sigma^2 + FirstTerm + SecondTerm$;