CS401 Lecture Notes – 1st December, 2014 LECTURE NOTES 19

MACHINE LEARNING: -Supervised

-Unsupervised

-RL Learning

Unsupervised learning: “Matrix decomposition”.

How can we take the Matrix apart?

Easiest way – Factor it.

Data Matrix:

x = (x(1)| x(2) | .. x(m) ) n=dim of input

m= number of samples

“take this matrix and approximate as product of 2 matrix”

X ≈ Y Z

(nxm) (nxk) (kxm)

1. Choose small k – low rank decomposition
2. Make Y and /or Z sparse
3. Make Y , Z, >= 0 (elementwise)

Min

Y,Z ||X-YZ||

s.t conditions

k means

(going to do small k (1) and make sparse (2))

\_\_\_# samples\_\_\_

X = (x(1) | ... | x(m)) ≈ ( c(1) |c(2)|c(3)|c(4)|...) =

(c(1)|c(2)|...|c(k)) (1 0 0 0 0 0|1 0 0 0 0 0 |1 0 0 0 0 0|0 1 0 0 0 0| 0 0 0 0 0 1| ...)

K means binary matrix

Z=0 except single on in each column

n

X = **Σ**  λ CLi CRTi (left and right eigenvector)

i-1

c = (c1|c2|..|cn) ,  Λ = ( λ...  λn)

x= Λcc+

=(x1 ... xn) (c1|c2|...|cn)(c1+|c2+|..|cn+)

0<= λn<= λnm<=..<= λ1

Principle Components Analysis

=PCA

Xx+

Single Value Decomposition