Putting fun into data analysis with F#

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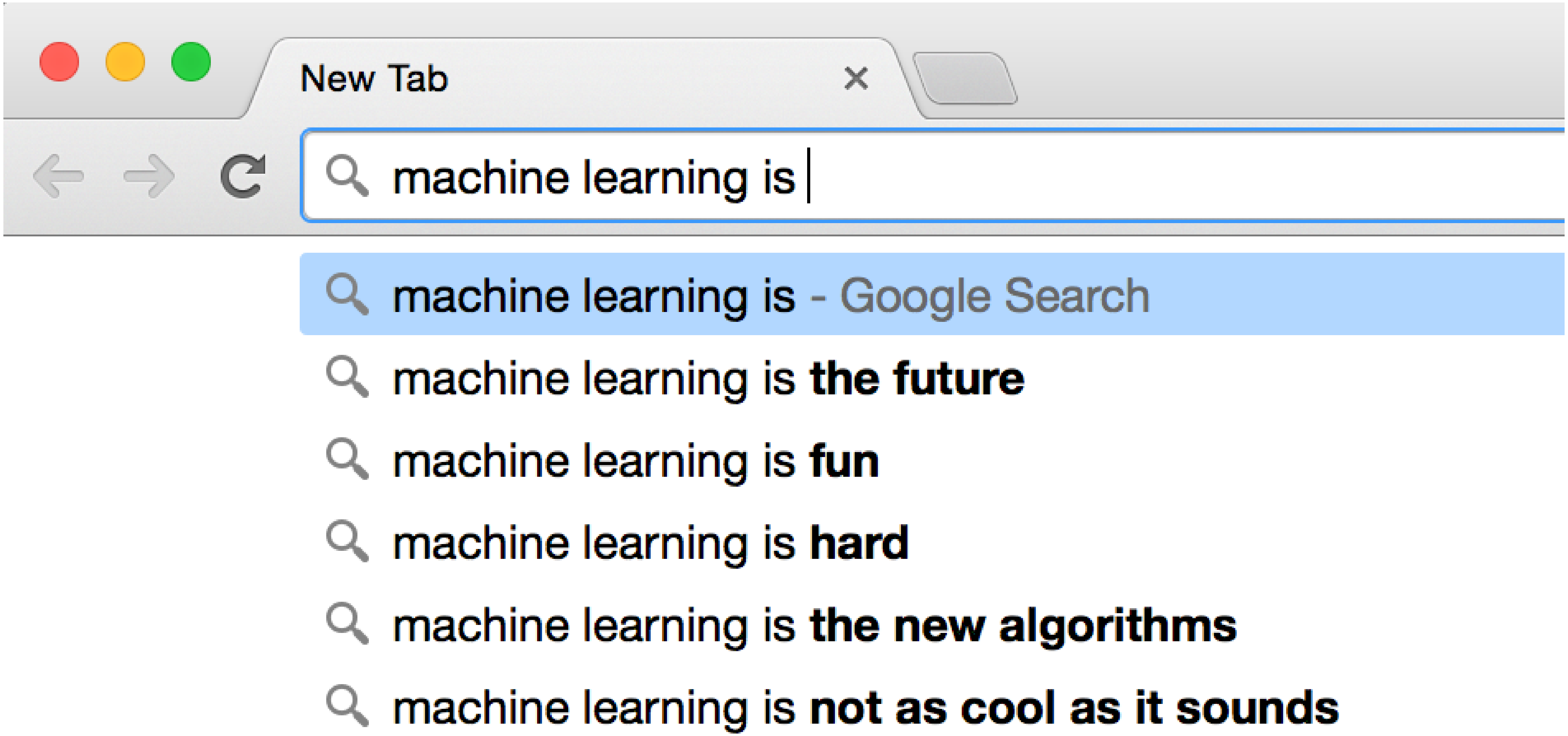
ØREDEV

Machine learning



machine learning is

machine learning is - Google Search

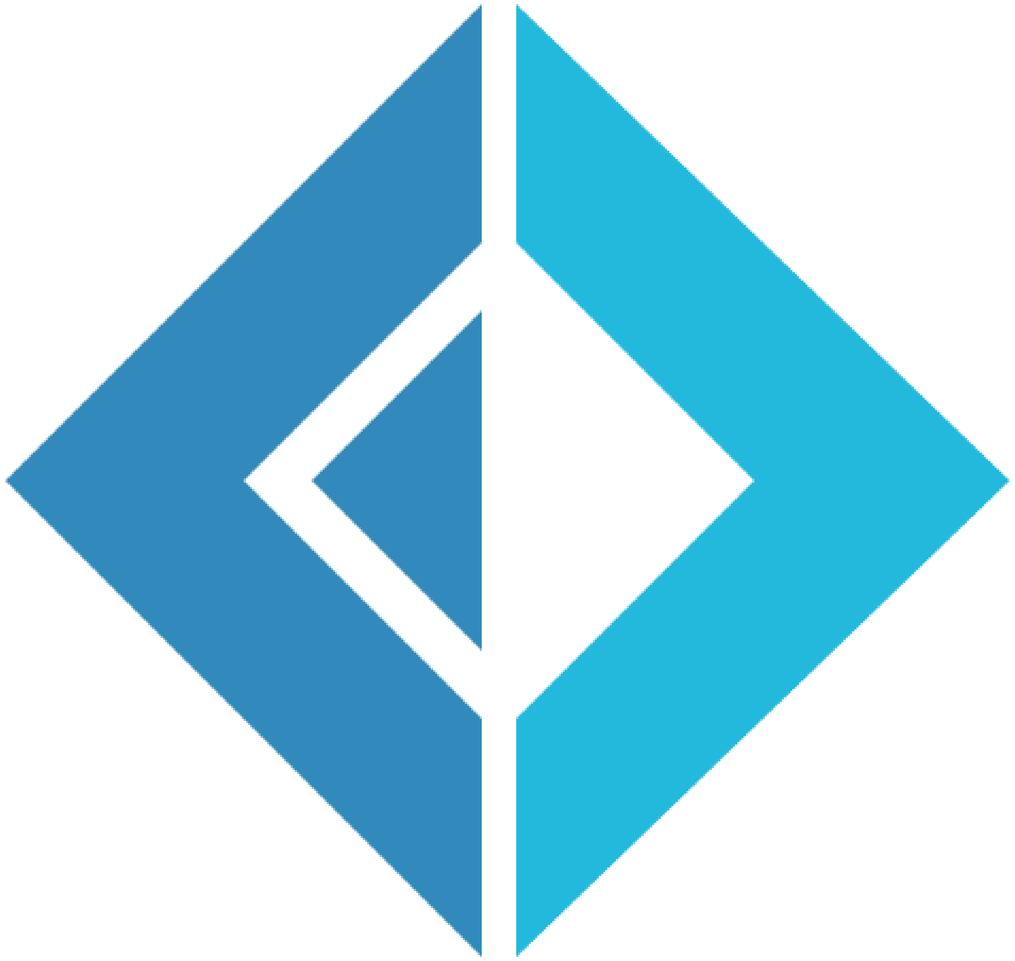
machine learning is **the future**

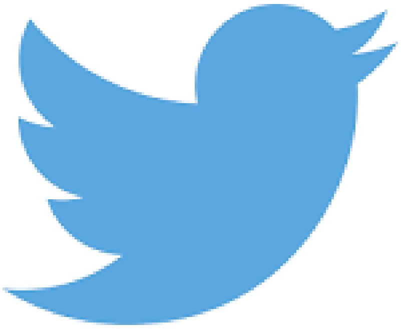
machine learning is **fun**

machine learning is **hard**

machine learning is **the new algorithms**

machine learning is **not as cool as it sounds**

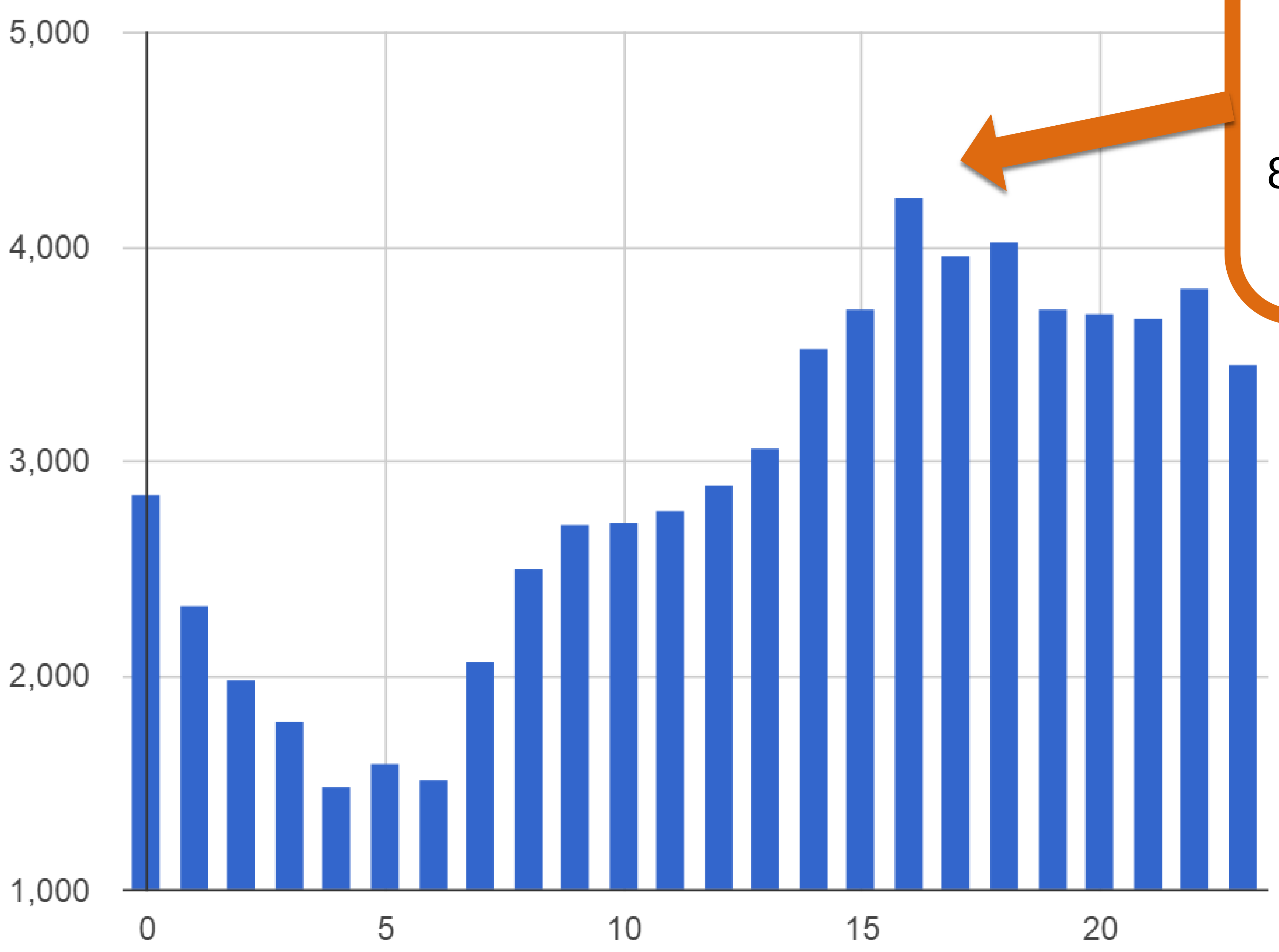




With F# about F#

What is the community’s dynamics?

When do people tweet?



16:00 in London

11:00 in New York

8:00 in San Francisco

0:00 in Tokyo

Growth of the community

$$N = w_0 + w_1 D + \epsilon$$

D	Date
N	Number of people tweeting

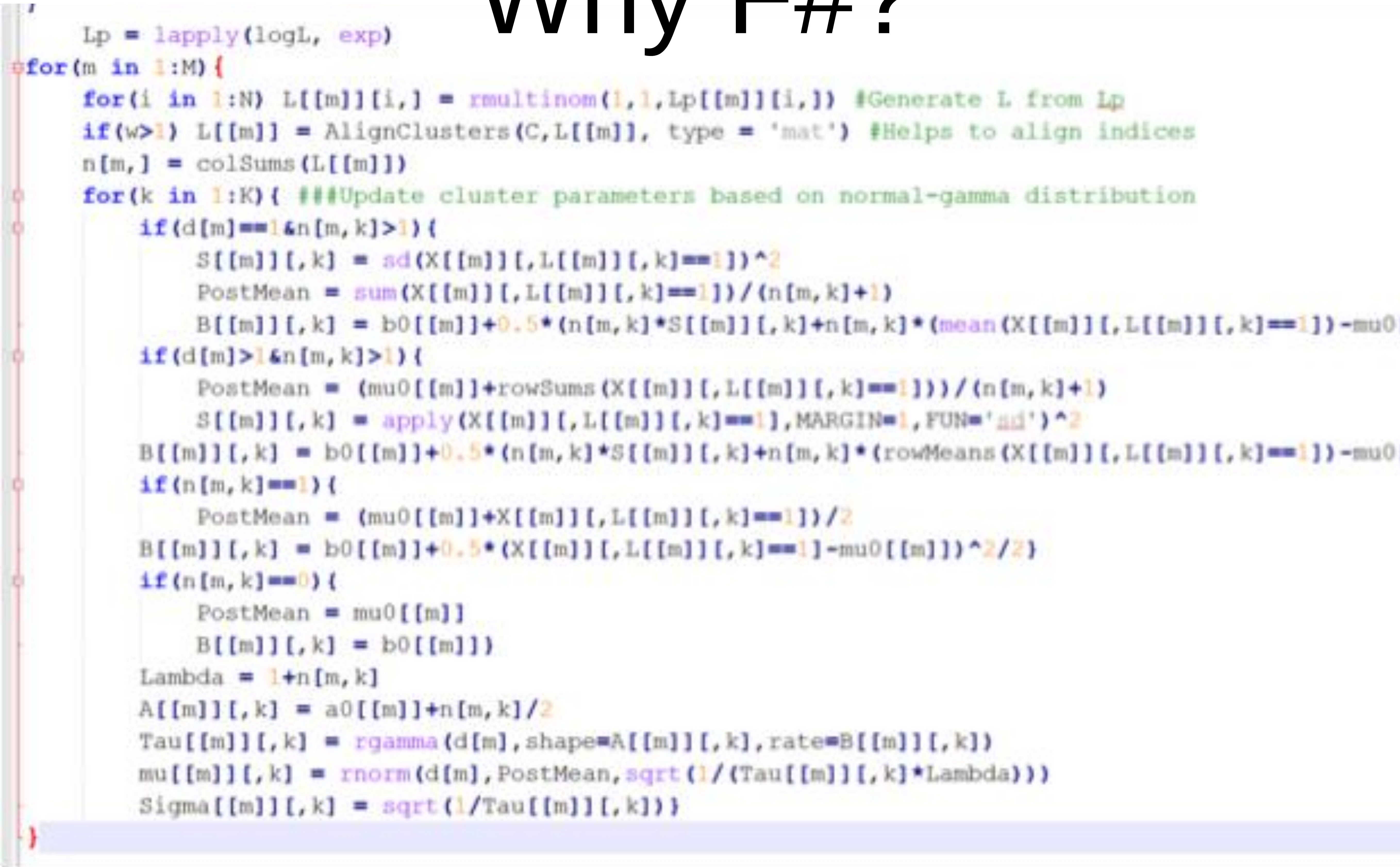
Programming
in data science

Scripting languages

fast prototyping, easy to use

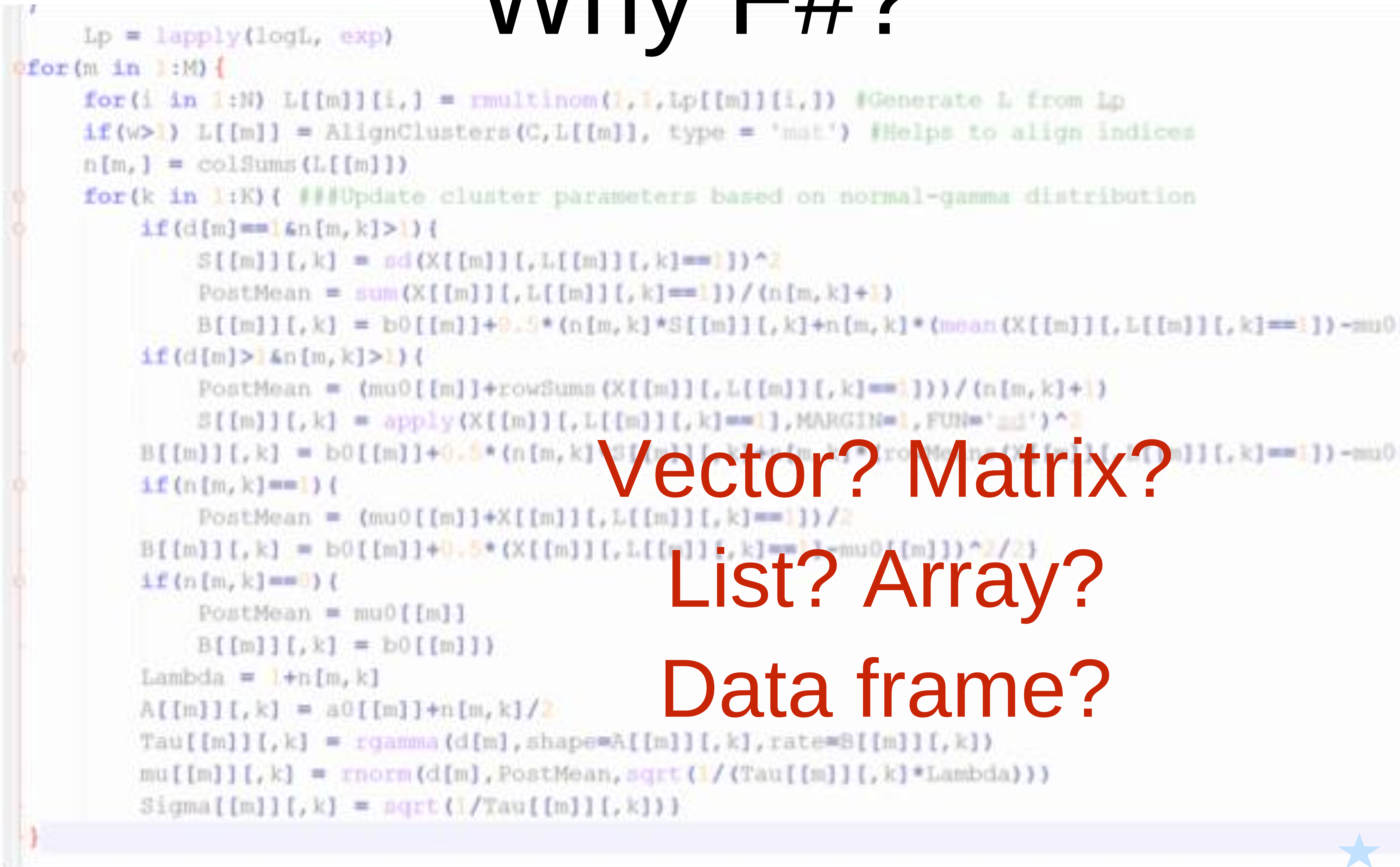
R, Python, Matlab

Why F#?



```
    Lp = lapply(logL, exp)
for(m in 1:M){
    for(i in 1:N) L[[m]][i,] = rmultinom(1,1,Lp[[m]][i,]) #Generate L from Lp
    if(w>1) L[[m]] = AlignClusters(C,L[[m]], type = 'mat') #Helps to align indices
    n[m,] = colSums(L[[m]])
    for(k in 1:K){ ###Update cluster parameters based on normal-gamma distribution
        if(d[m]==1&n[m,k]>1){
            S[[m]][,k] = sd(X[[m]][,L[[m]][,k]==1])^2
            PostMean = sum(X[[m]][,L[[m]][,k]==1])/(n[m,k]+1)
            B[[m]][,k] = b0[[m]]+0.5*(n[m,k]*S[[m]][,k]+n[m,k]*(mean(X[[m]][,L[[m]][,k]==1])-mu0
        if(d[m]>1&n[m,k]>1){
            PostMean = (mu0[[m]]+rowSums(X[[m]][,L[[m]][,k]==1]))/(n[m,k]+1)
            S[[m]][,k] = apply(X[[m]][,L[[m]][,k]==1],MARGIN=1,FUN='sd')^2
        B[[m]][,k] = b0[[m]]+0.5*(n[m,k]*S[[m]][,k]+n[m,k]*(rowMeans(X[[m]][,L[[m]][,k]==1])-mu0
        if(n[m,k]==1){
            PostMean = (mu0[[m]]+X[[m]][,L[[m]][,k]==1])/2
        B[[m]][,k] = b0[[m]]+0.5*(X[[m]][,L[[m]][,k]==1]-mu0[[m]])^2/2)
        if(n[m,k]==0){
            PostMean = mu0[[m]]
            B[[m]][,k] = b0[[m]])
        Lambda = 1+n[m,k]
        A[[m]][,k] = a0[[m]]+n[m,k]/2
        Tau[[m]][,k] = rgamma(d[m],shape=A[[m]][,k],rate=B[[m]][,k])
        mu[[m]][,k] = rnorm(d[m],PostMean,sqrt(1/(Tau[[m]][,k]*Lambda)))
        Sigma[[m]][,k] = sqrt(1/Tau[[m]][,k]))
}
```

Why F#?



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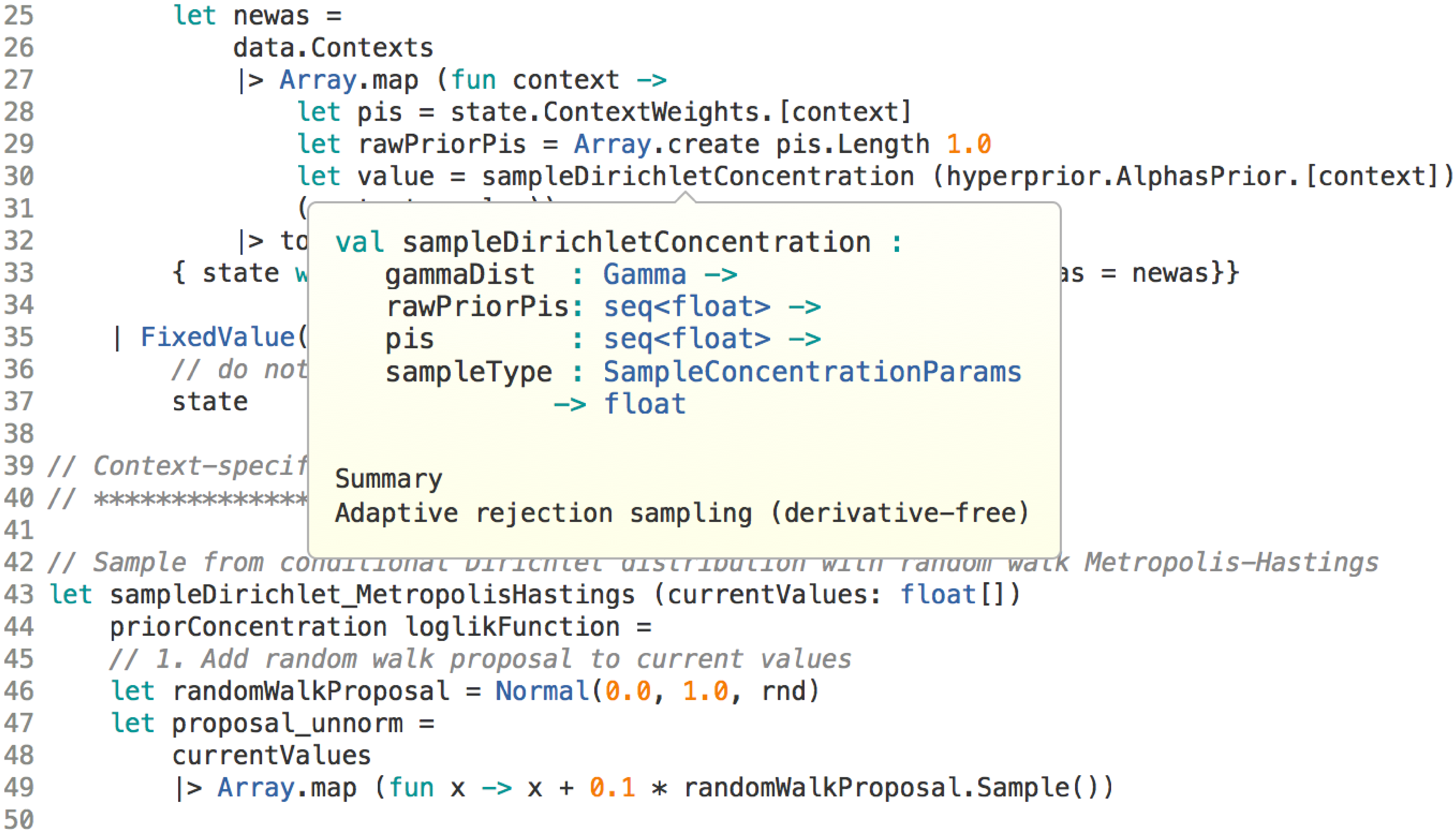
        if(n[m,k]==1){
            PostMean = (mu0[[m]]+X[[m]][,L[[m]][,k]==1])/2
        B[[m]][,k] = b0[[m]]+0.5*(X[[m]][,L[[m]][,k]==1]-mu0[[m]])^2/2)
        if(n[m,k]==0){
            PostMean = mu0[[m]]
            B[[m]][,k] = b0[[m]])
        Lambda = 1+n[m,k]
        A[[m]][,k] = a0[[m]]+n[m,k]/2
        Tau[[m]][,k] = rgamma(d[m],shape=A[[m]][,k],rate=B[[m]][,k])
        mu[[m]][,k] = rnorm(d[m],PostMean,sqrt(1/(Tau[[m]][,k]*Lambda)))
        Sigma[[m]][,k] = sqrt(1/Tau[[m]][,k]))
}
```

Vector? Matrix?

List? Array?

Data frame?

Why F#?



```
        let newas =
            data.Contexts
            |> Array.map (fun context ->
                let pis = state.ContextWeights.[context]
                let rawPriorPis = Array.create pis.Length 1.0
                let value = sampleDirichletConcentration (hyperprior.AlphasPrior.[context])
                (
            |> to
        { state w                                        as = newas}}

    | FixedValue(
        // do not
        state
```

```
val sampleDirichletConcentration :
   gammaDist   : Gamma ->
   rawPriorPis: seq<float> ->
   pis         : seq<float> ->
   sampleType : SampleConcentrationParams
             -> float


Summary
Adaptive rejection sampling (derivative-free)
```

```

// Context-specif
// **************

// Sample from conditional Dirichlet distribution with random walk Metropolis-Hastings
let sampleDirichlet_MetropolisHastings (currentValues: float[])
    priorConcentration loglikFunction =
    // 1. Add random walk proposal to current values
    let randomWalkProposal = Normal(0.0, 1.0, rnd)
    let proposal_unnorm =
        currentValues
        |> Array.map (fun x -> x + 0.1 * randomWalkProposal.Sample())

```

Answering real questions:

Are people happy with F#?

Sentiment analysis

The movie was funny.

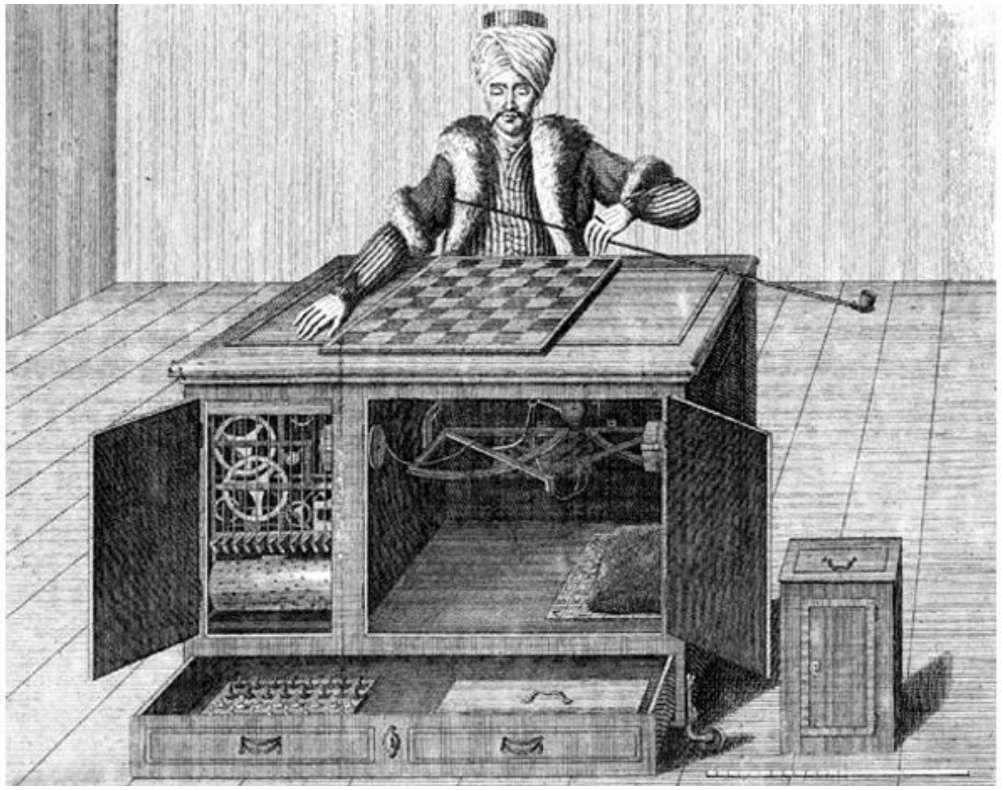
The movie was trying to be funny.

Sentiment analysis

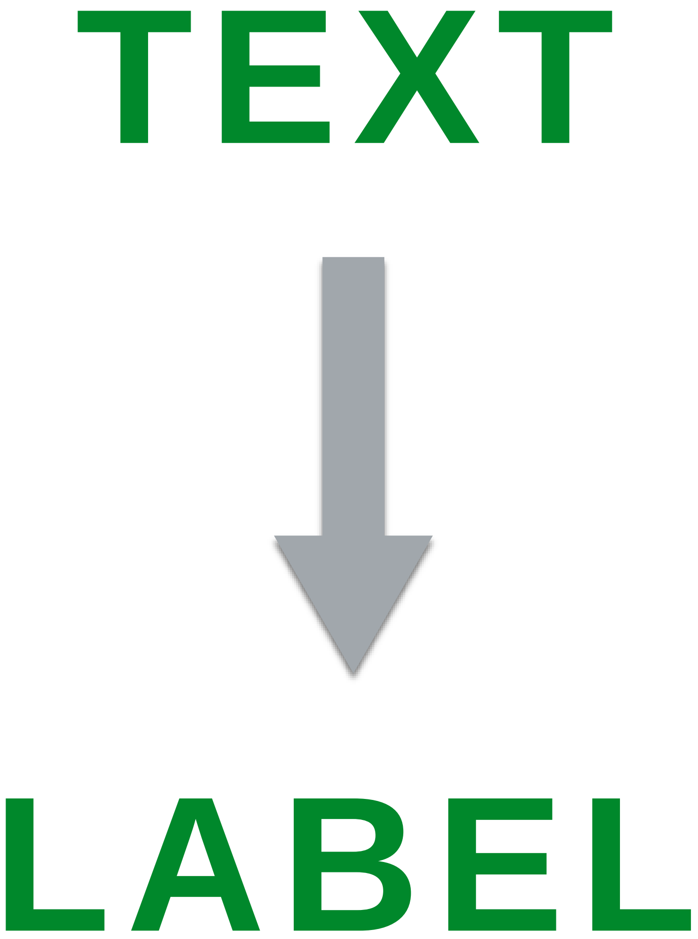
Stanford NLP library

How to find sentiment from text?

Humans are good at this but computers are not!

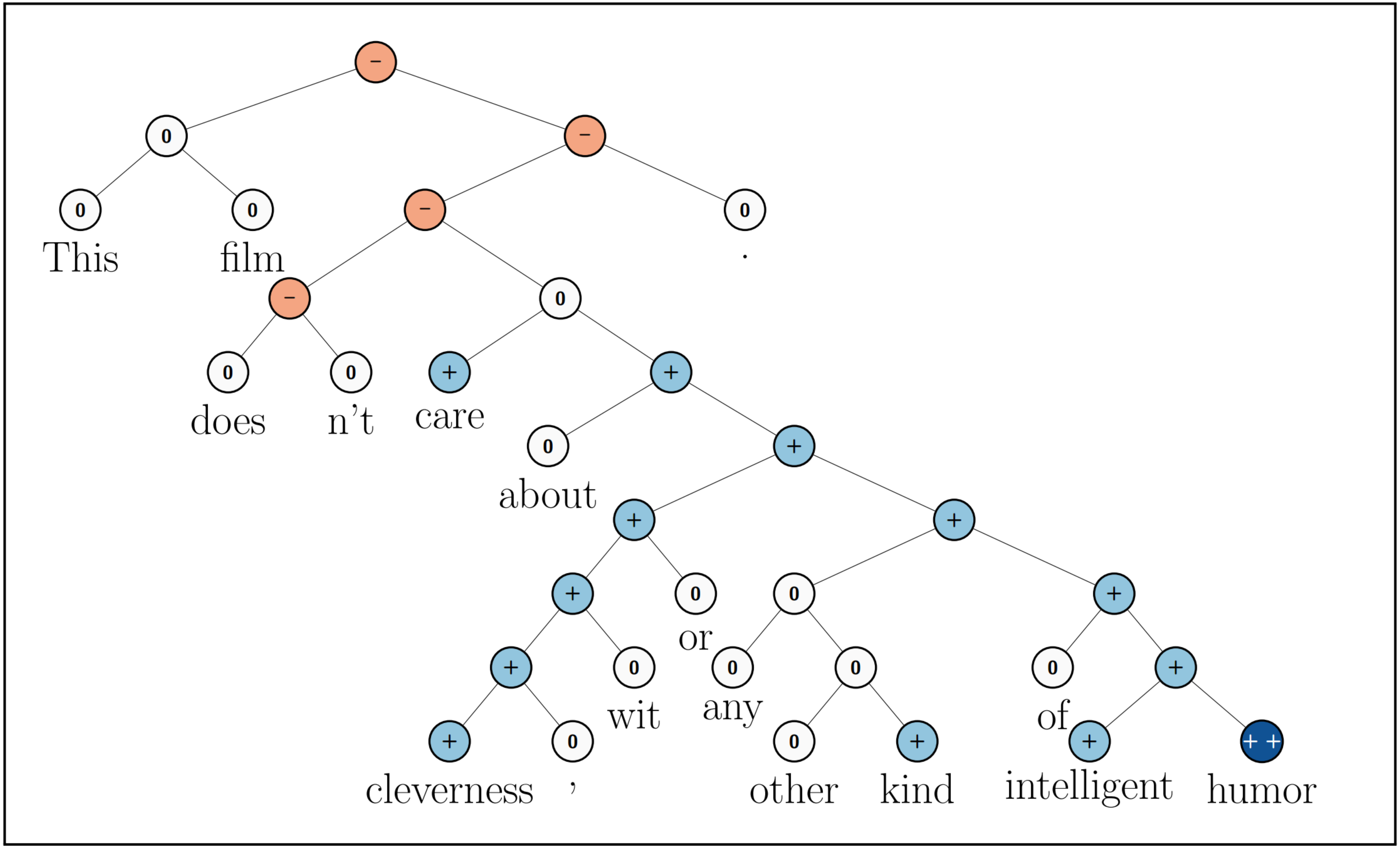


Supervised learning



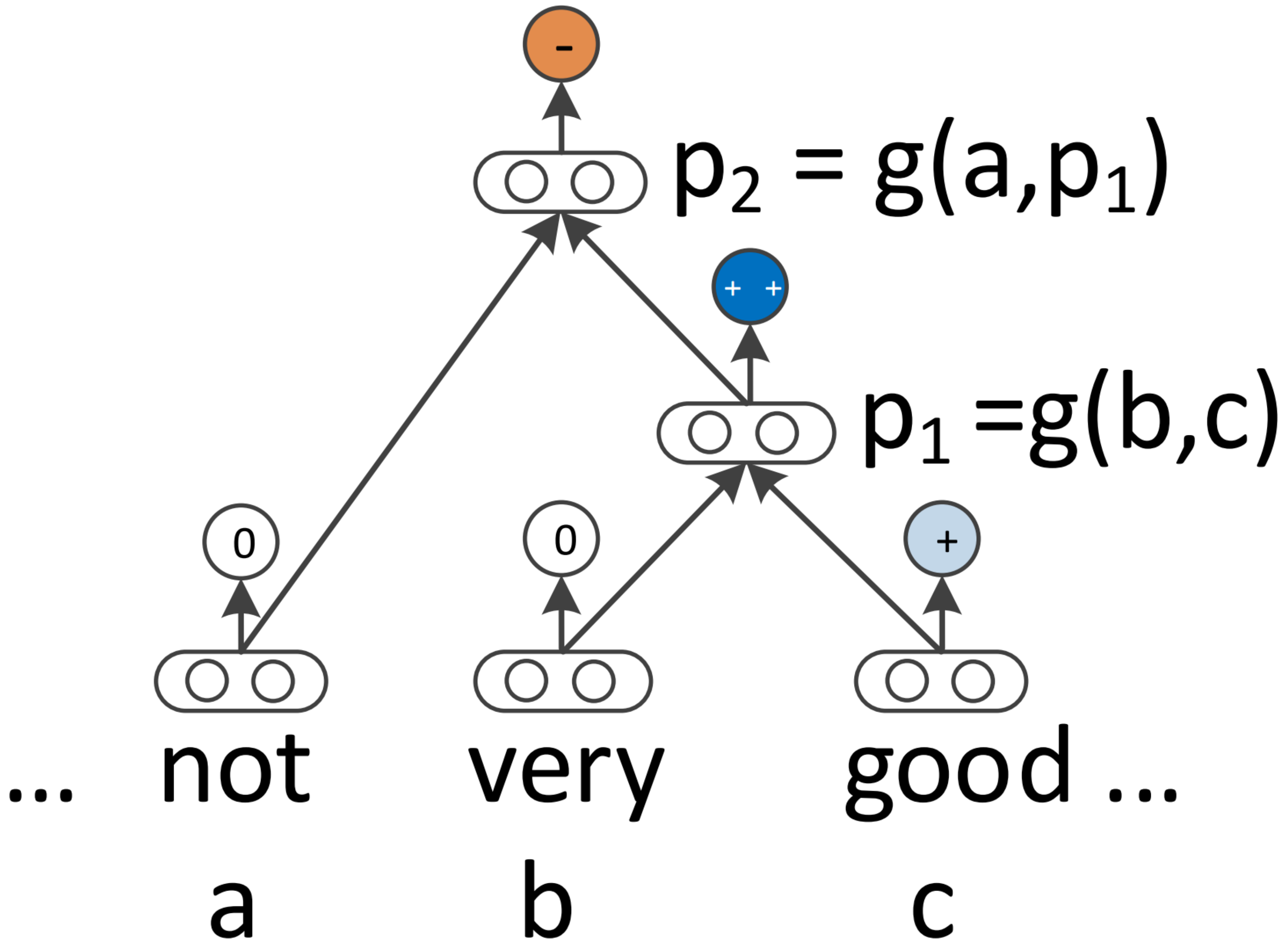
TEXT

LABEL



Richard Socher, Alex Perelygin, Jean Wu,Jason Chuang, Christopher Manning, Andrew Ng and Christopher Potts: Recursive Deep Models for Semantic Compositionality Over a Sentiment Treebank

Deep recurrent neural networks



Turning analysis into an app

#oredev

Why F#?

- Interactive exploration of data & incorporation into larger applications
- Static typing helps
- Type providers for easy data access
- RProvider allows calling R functions

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