Hands-on: Sparkling Water

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Can I call H2O algorithms from my Spark workflow?

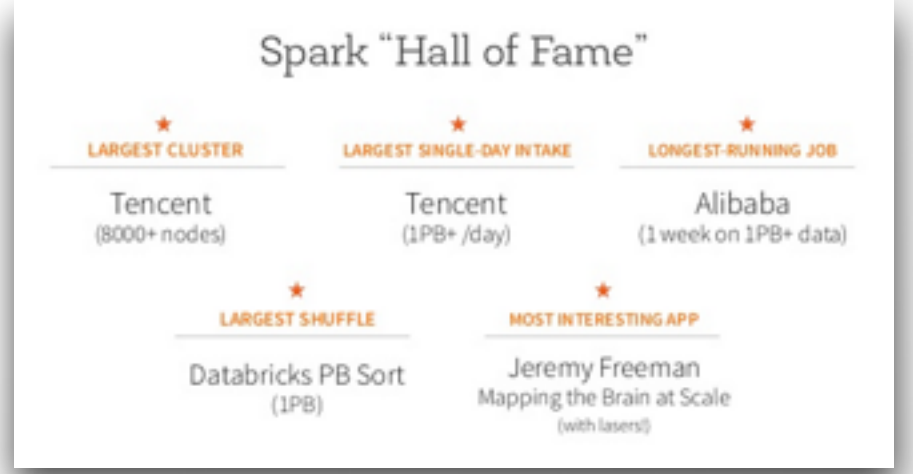
Open-source distributed execution platform

User-friendly API for data transformation based on DataFrames

Platform components - SQL, MLLib, NLP

Multitenancy

Large and active community



Can I call H2O algorithms from my Spark workflow?

YES,
you can!

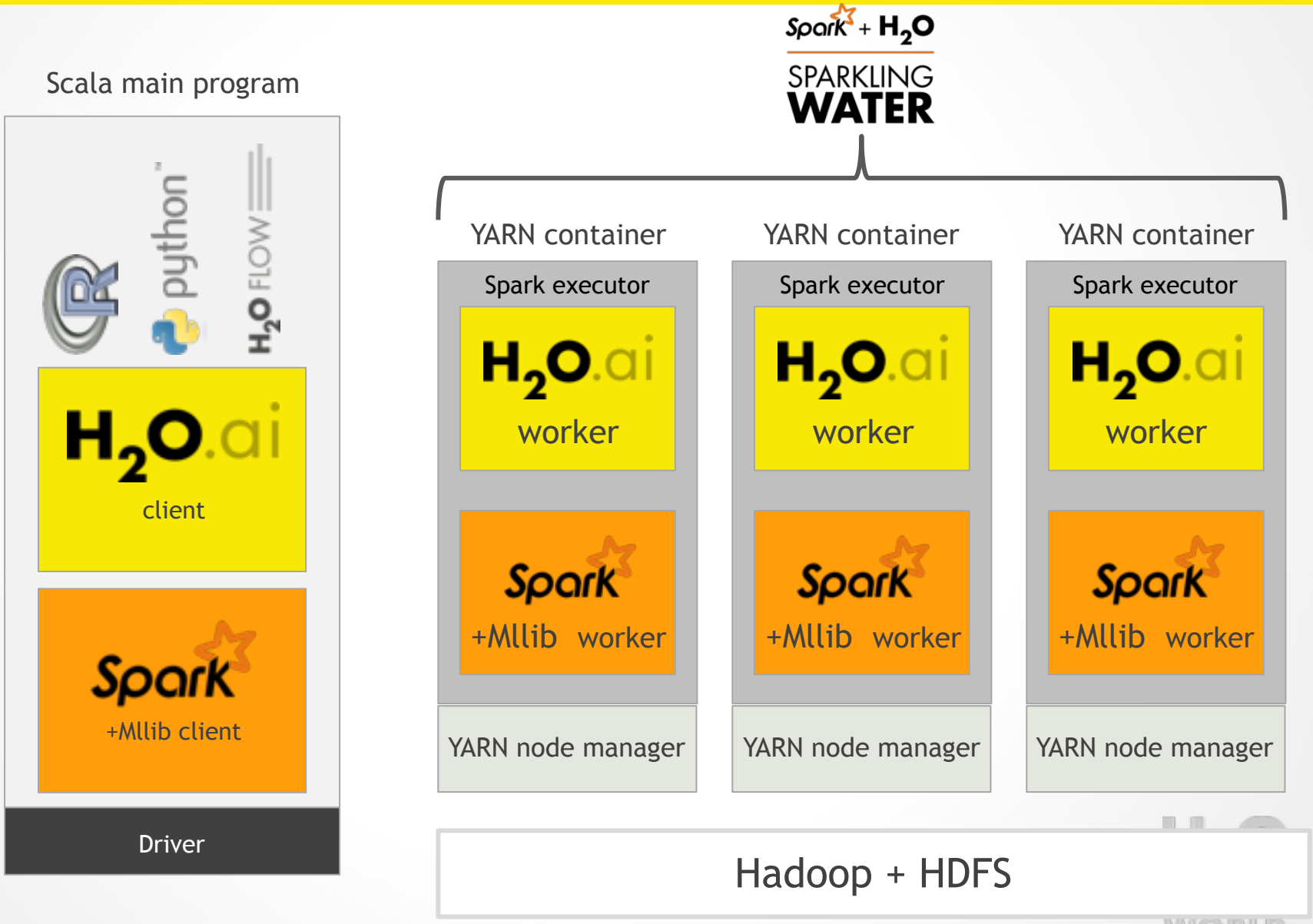
Sparkling Water

Provides

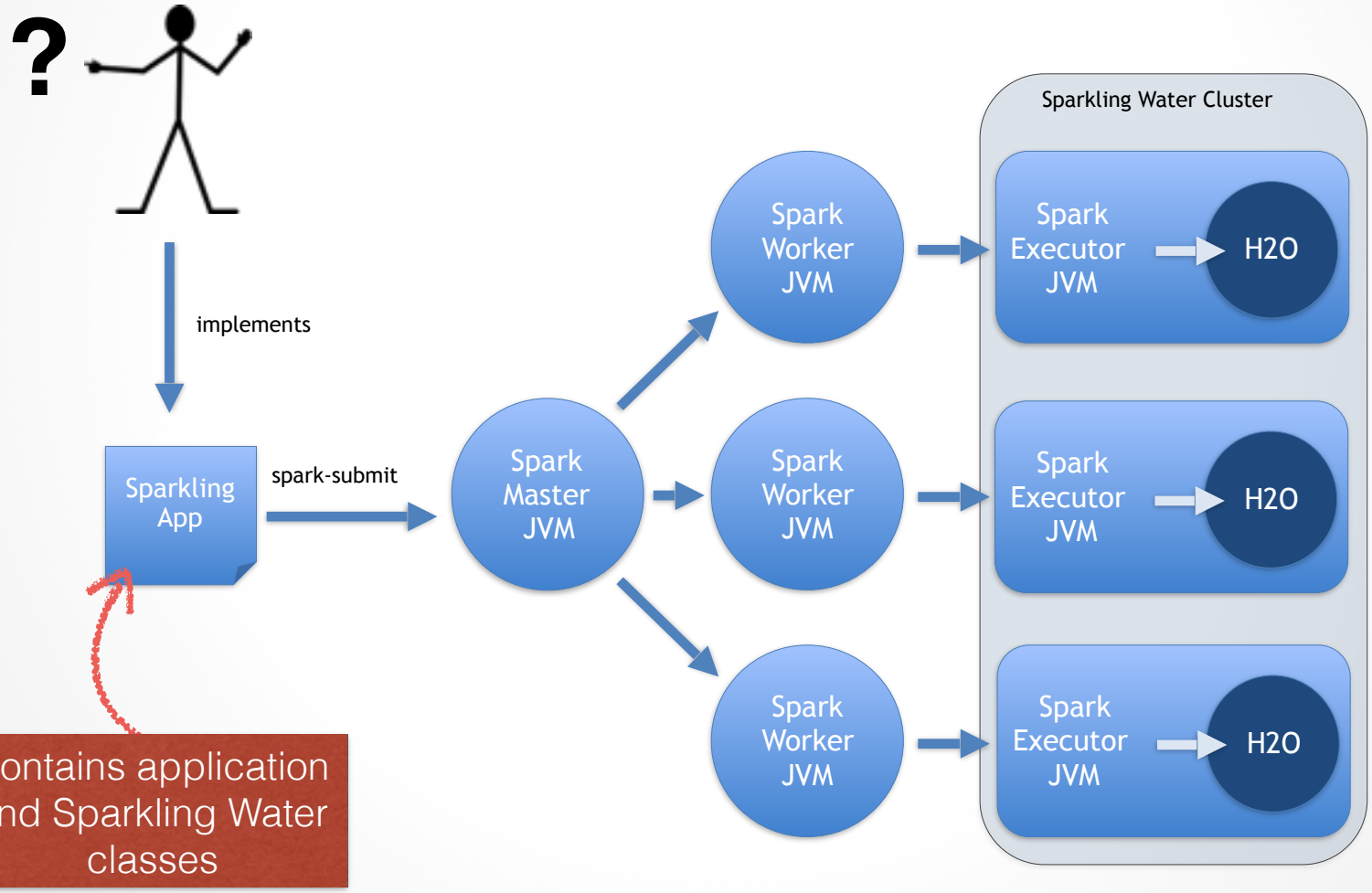
- Transparent integration of H2O with Spark ecosystem
- Transparent use of H2O data structures and algorithms with Spark API
- Platform for building **Smarter Applications**

Excels in existing Spark workflows requiring advanced Machine Learning algorithms

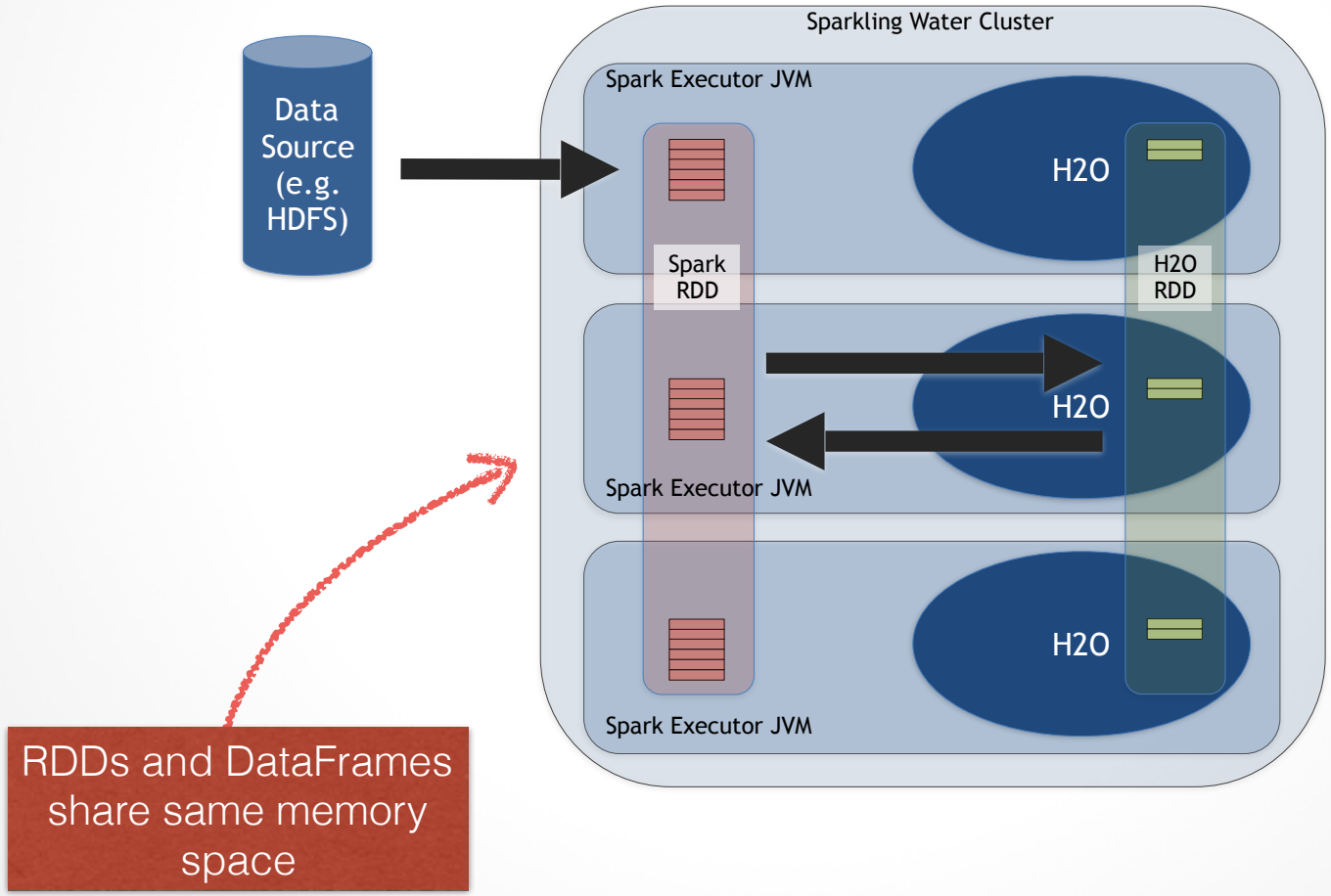
Sparkling Water cluster of size 3 on YARN



Sparkling Water Application Lifecycle



Data Sharing



Lets play with it!

OR

Detect spam text messages

H2O WORLD

Data example

	A	B
1	ham	Ok... But they said i've got wisdom teeth hidden inside n mayb need 2 remove.
2	ham	U thk of wat to eat tonight.
3	ham	I dunno until when... Lets go learn pilates...
4	spam	Someonone you know is trying to contact you via our dating service! To find out who it could be call from your mobile or landline 09064015307 BOX334SK38ch
5	ham	Ok c u then.
6	spam	URGENT! We are trying to contact U. Todays draw shows that you have won a £800 prize GUARANTEED. Call 09050003091 from land line. Claim C52. Valid12hrs only
7	spam	Not heard from U4 a while. Call 4 rude chat private line 01223585334 to cum. Wan 2C pics of me gettin shagged then text PIX to 8552. 2End send STOP 8552 SAM xxx
8	ham	staff.science.nus.edu.sg/~phyhcmk/teaching/pc1323
9	ham	Thank god they are in bed!
10	ham	Hey tmr meet at bugis 930 ?
11	spam	You are a winner you have been specially selected to receive £1000 cash or a £2000 award. Speak to a live operator to claim call 087123002209am-7pm. Cost 10p
12	spam	URGENT! Your Mobile No. was awarded £2000 Bonus Caller Prize on 5/9/03 This is our final try to contact U! Call from Landline 09064019788 BOX42WR29C, 150PPM
13	spam	Loan for any purpose £500 - £75,000. Homeowners + Tenants welcome. Have you been previously refused? We can still help. Call Free 0800 1956669 or text back 'help'
14	ham	Haha... Sounds crazy, dunno can tahan anot...
15	spam	You have won ?spam 000 cash or a ?2,000 prize! To claim, call09050000327
16	ham	Sorry i din lock my keypad.
17	ham	Thanx but my birthday is over already.
18	spam	FREE for 1st week! No1 Nokia tone 4 ur mobile every week just txt NOKIA to 8077 Get txting and tell ur mates. www.getzed.co.uk POBox 36504 W45WQ 16+ norm150p/tone
19	spam	Congratulations - Thanks to a good friend U have WON the £2,000 Xmas prize. 2 claim is easy, just call 08712103738 NOW! Only 10p per minute. BT-national-rate
20	ham	Me n him so funny...
21	spam	pdate_Now - Double mins and 1000 txts on Orange tariffs. Latest Motorola, SonyEricsson & Nokia & Bluetooth FREE! Call MobileUpd8 on 08000839402 or call2optout/!YHL
22	ham	Ok...
23	ham	Yup no more already... Thanx 4 printing n handing it up.
24	ham	Anything lor. Juz both of us lor.
25	ham	It's é only $140 ard...É rest all ard $180 at least...Which is é price 4 é 2 bedrm ($900)
26	ham	Oh oh... Den muz change plan liao... Go back have to yan jiu again...
27	ham	Ok lor then we go tog lor...
28	ham	Okay lor... Wah... like that def they wont let us go... Haha... What did they say in the terms and conditions?
29	ham	Dunno lei... I thk mum lazy to go out... I neva ask her yet...
30	ham	THATS ALRITE GIRL, U KNOW GAIL IS NEVA WRONG!!TAKE CARE SWEET AND DONT WORRY.C U L8TR HUN!LOVE Yaxxx

ML Workflow

Goal: For a given text message identify if it is spam or not

1. Extract data
2. Transform, tokenize messages
3. Build Tf-IDF model
4. Create and evaluate Deep Learning model
5. Use the model to dete spam

Application environment

Lego #1: Data load

```
// Data load
def load(dataFile: String): RDD[Array[String]] = {
  sc.textFile(dataFile).map(l => l.split("\t"))
                                    .filter(r => !r(0).isEmpty)
  }
```

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Lego #2: Ad-hoc Tokenization

```
def tokenize(data: RDD[String]): RDD[Seq[String]] = {
  val ignoredWords = Seq("the", “a", …)
  val ignoredChars = Seq(',', ‘:’, …)

  val texts = data.map( r => {
    var smsText = r.toLowerCase
    for( c <- ignoredChars) {
      smsText = smsText.replace(c, ' ')
    }

    val words =smsText.split(" ").filter(w =>
                  !ignoredWords.contains(w) && w.length>2).distinct
    words.toSeq
  })
  texts
}
```

Lego #3: Tf-IDF

```
def buildIDFModel(tokens: RDD[Seq[String]],
                  minDocFreq:Int = 4,
                  hashSpaceSize:Int = 1 << 10):
                  (HashingTF, IDFModel, RDD[Vector]) = {
  // Hash strings into the given space
  val hashingTF = new HashingTF(hashSpaceSize)
  val tf = hashingTF.transform(tokens)

  // Build term frequency-inverse document frequency
  val idfModel = new IDF(minDocFreq=minDocFreq).fit(tf)
  val expandedText = idfModel.transform(tf)
  (hashingTF, idfModel, expandedText)
}
```

Hash words into large space

Term freq scale

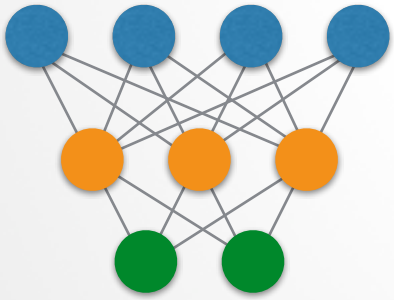
"Thank for the order…" →

[…,0,3.5,0,1,0,0.3,0,1.3,0,0,…]

Thank Order

Lego #4: Build a model

Deep Learning: Create multi-layer feed forward neural networks starting with an input layer followed by multiple layers of nonlinear transformations



```
def buildDLModel(train: Frame, valid: Frame, epochs: Int = 10,
                 l1: Double = 0.001, l2: Double = 0.0,
                 hidden: Array[Int] = Array[Int](200, 200))
                (implicit h2oContext: H2OContext): DeepLearningModel =
{
  import h2oContext._
  // Build a model
  val dlParams = new DeepLearningParameters()
  dlParams._destination_key = Key.make("dlModel.hex")
  dlParams._train = train
  dlParams._valid = valid
  dlParams._response_column = 'target
  dlParams._epochs = epochs
  dlParams._l1 = l1
  dlParams._hidden = hidden

  // Create a job
  val dl = new DeepLearning(dlParams)
  val dlModel = dl.trainModel.get

  // Compute metrics on both datasets
  dlModel.score(train).delete()
  dlModel.score(valid).delete()

  dlModel
}
```

Assembly final workflow

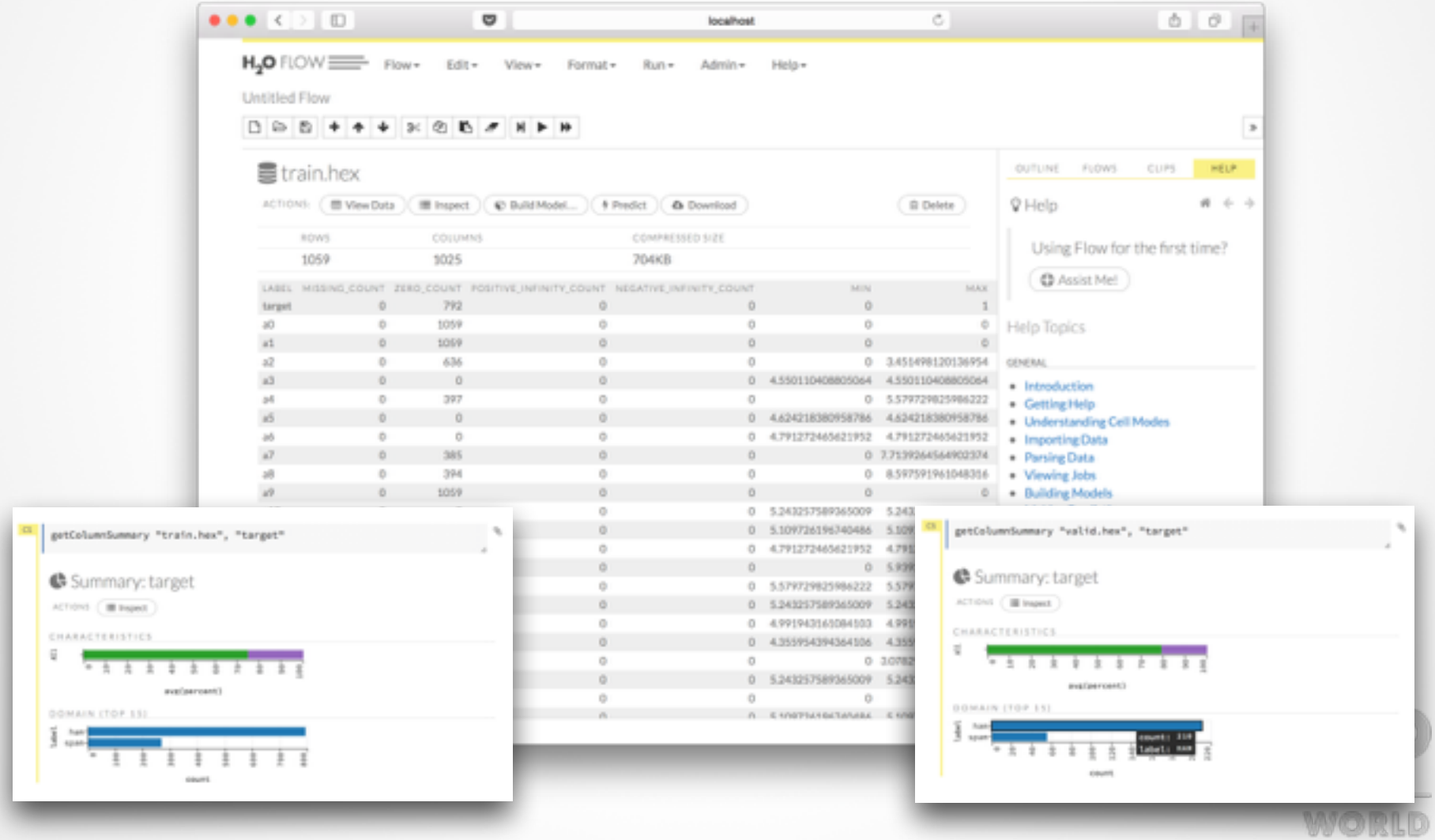
```
// Data load
val data = load(DATAFILE)
// Extract response spam or ham
val hamSpam = data.map( r => r(0))
val message = data.map( r => r(1))
// Tokenize message content
val tokens = tokenize(message)

// Build IDF model
var (hashingTF, idfModel, tfidf) = buildIDFModel(tokens)

// Merge response with extracted vectors
val resultDF = hamSpam.zip(tfidf).map(v => SMS(v._1, v._2))
val tableHF:H2OFrame = resultDF

// Split table
val keys = Array[String]("train.hex", "valid.hex")
val ratios = Array[Double](0.8)
val frs = split(table, keys, ratios)
val (train, valid) = (frs(0), frs(1))
table.delete()

// Build a model
val dlModel = buildDLModel(train, valid)
```

Data munging in Spark

H2O Split dataset

Build H2O model

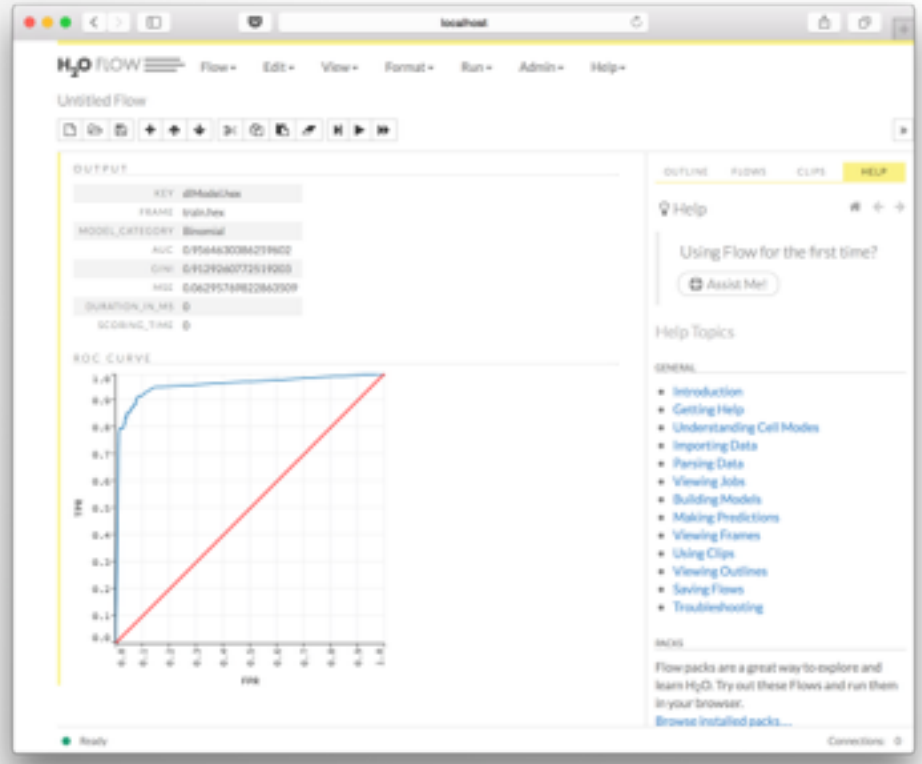
H2O Flow: Data exploration

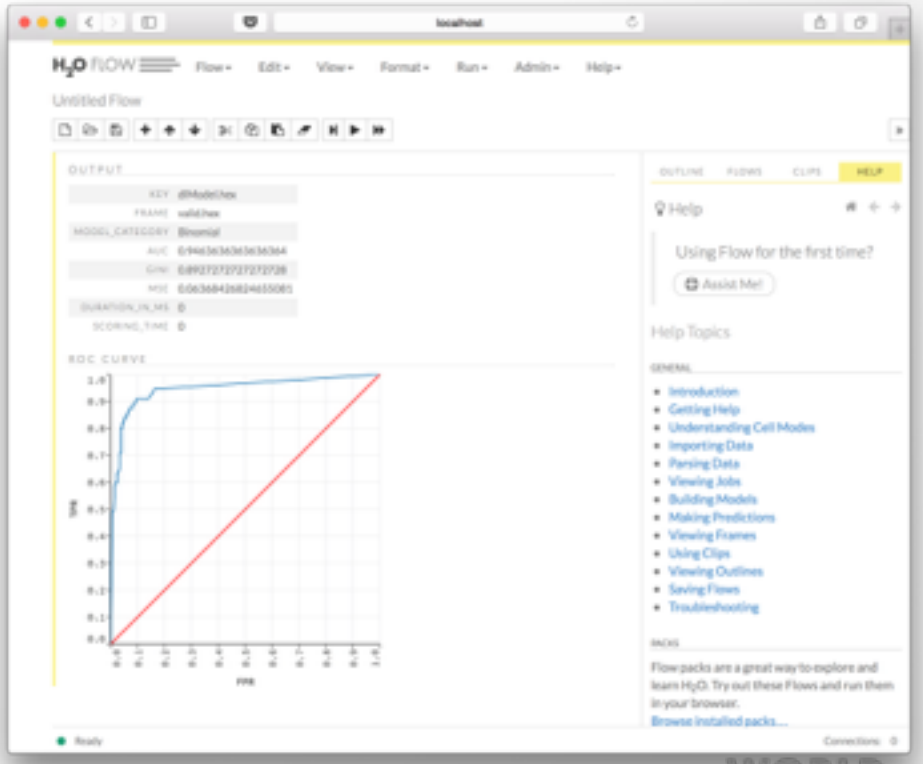


H2O Flow: Model evaluation

```
val trainMetrics = binomialMM(dlModel, train)
val validMetrics = binomialMM(dlModel, valid)
```

Collect model metrics





Spam predictor

Prepared models

Default decision threshold

```
def isSpam(msg: String,
           dlModel: DeepLearningModel,
           hashingTF: HashingTF,
           idfModel: IDFModel,
           hamThreshold: Double = 0.5):Boolean = {
  val msgRdd = sc.parallelize(Seq(msg))
  val msgVector: SchemaRDD = idfModel.transform(
                               hashingTF.transform (
                                 tokenize (msgRdd)))
                                   .map(v => SMS("?", v))
  val msgTable: DataFrame = msgVector
  msgTable.remove(0) // remove first column
  val prediction = dlModel.score(msgTable)

  prediction.vecs()(1).at(0) < hamThreshold
}
```

Model scoring

Predict spam

```
isSpam("Michal, H2OWorld party
tomorrow in MV?")
```

```
isSpam("We tried to contact
you re your reply
to our offer of a Video
Handset? 750
anytime any networks mins?
UNLIMITED TEXT?")
```

H2O.ai

Thank you!

Sparkling Water is
open-source
ML application platform
combining
power of Spark and H2O

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