Scala

putting the fun into functional programming

An interactive introduction to the language with Keoni D'Souza

Do you want to look at a language that allows you to implement FP nicely?

Do you want to look at a language that allows you to implement FP nicely?

Do you want to look at a language that has a similar syntax to one you've seen already?

Do you want

Do you war
at a languag
allows you
implement
nicely?

Do you want to look at a language that companies actually use?

Do you want to lool at a language that allows you to implement FP nicely?

Do you (not) like Haskell?

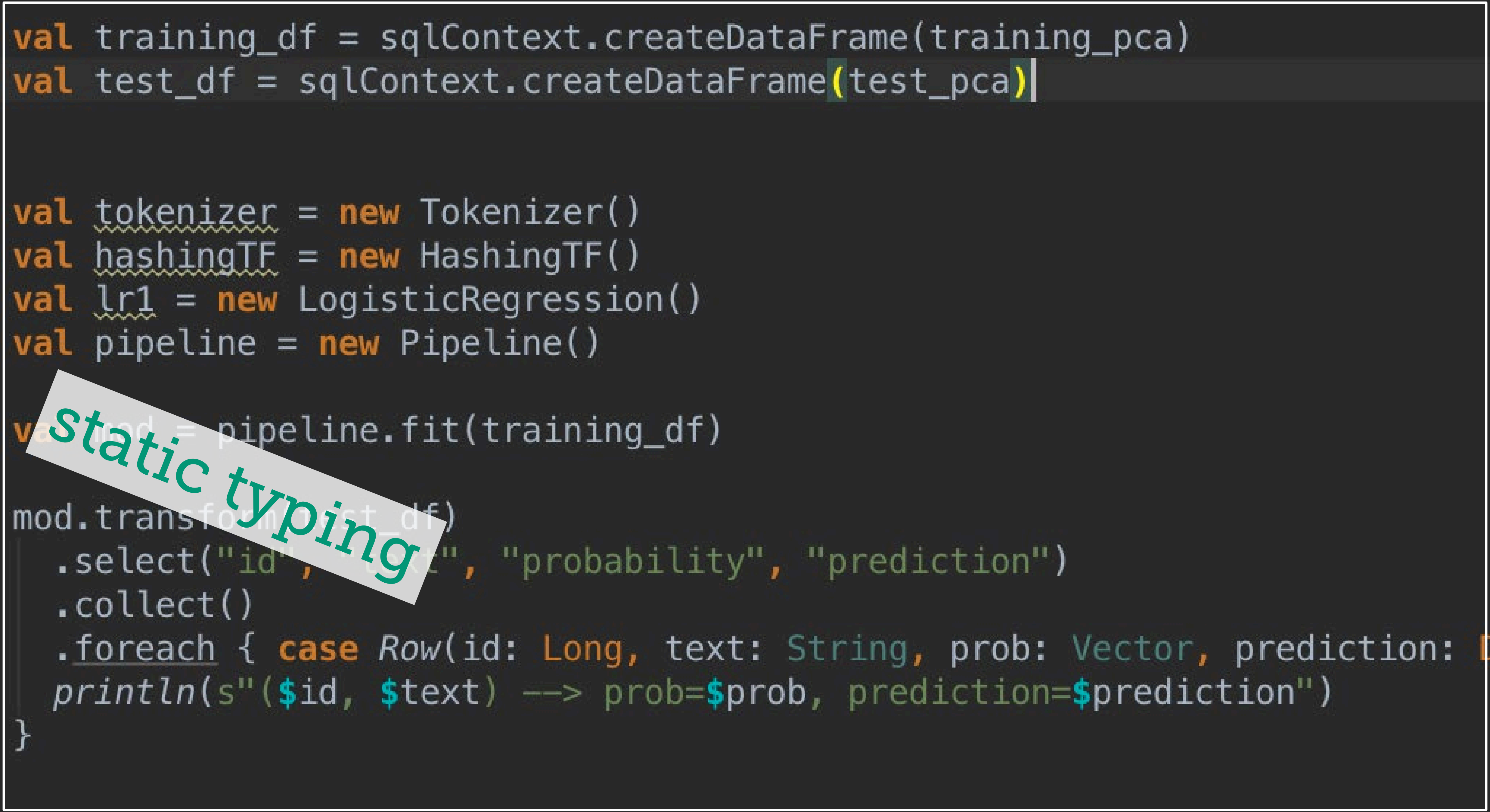
Do you want to look at a language that allows you implemen nicely?

Do you want to look at a language that has a similar

Well, aren't you in luck?!

o you ot) like askell?

Do you want to look at a language that companies actually use?



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  .foreach { case Row(id: Long, text: String, prob: Vector, prediction: Do
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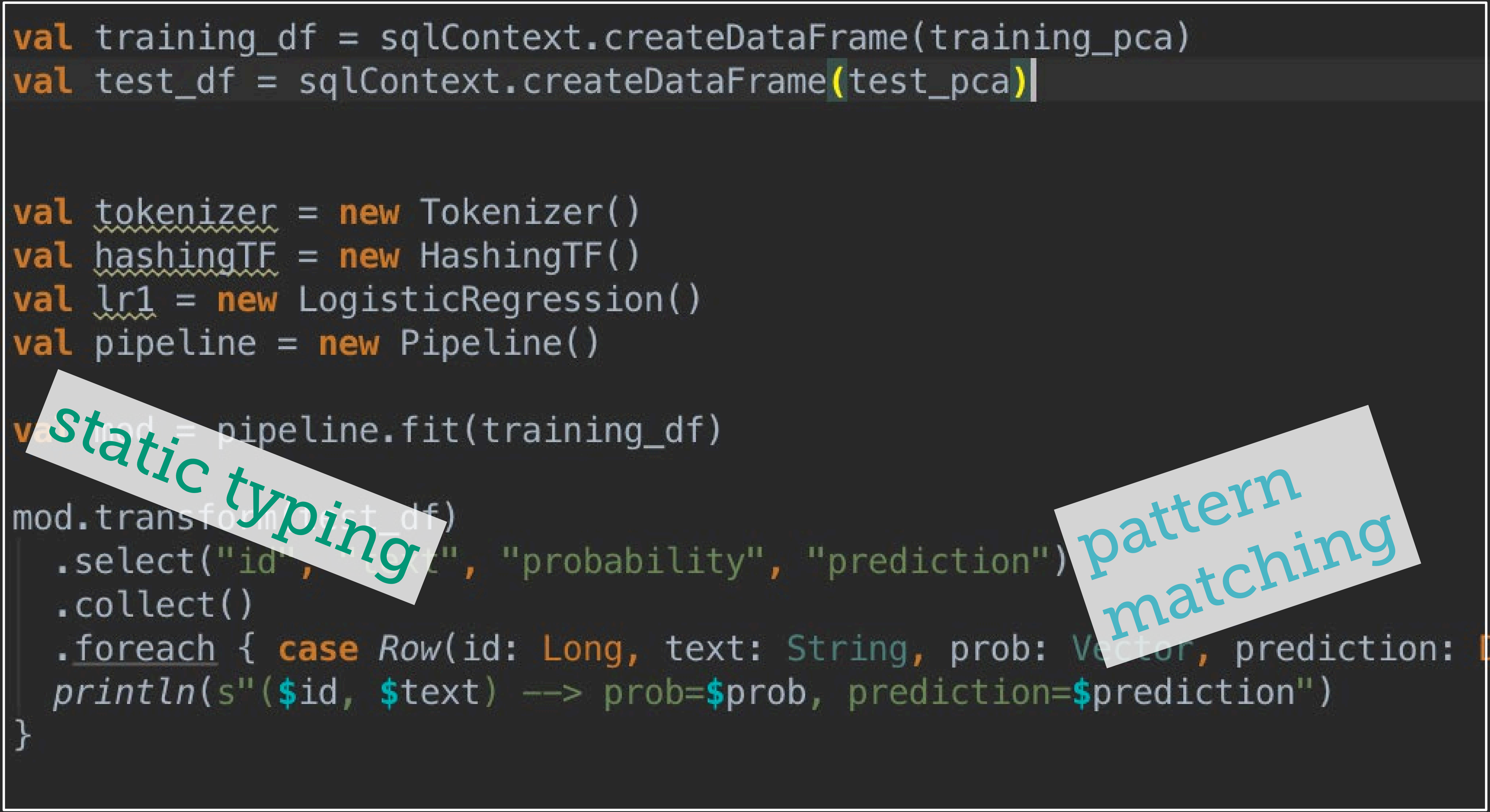
}
```

static typing



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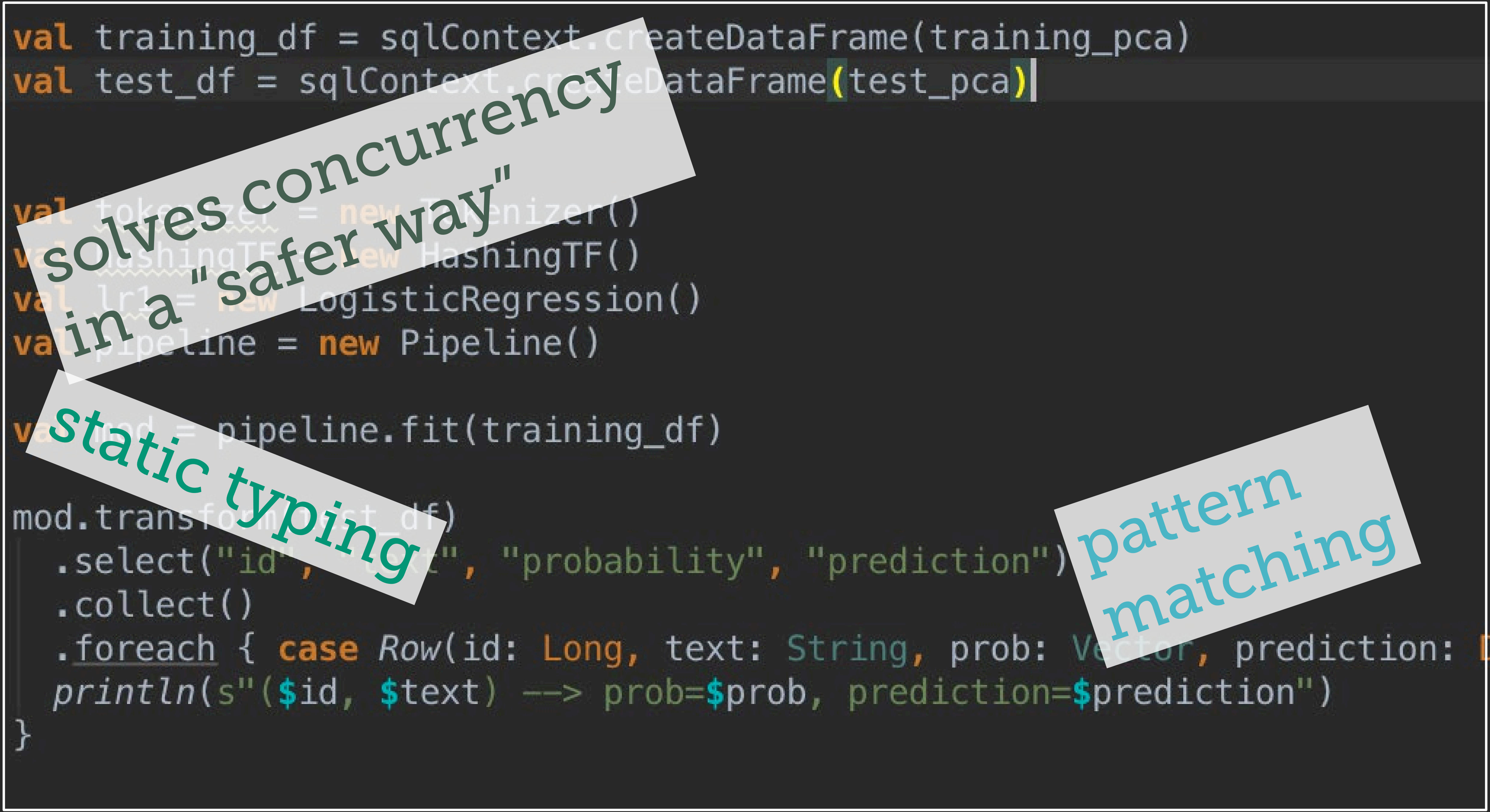

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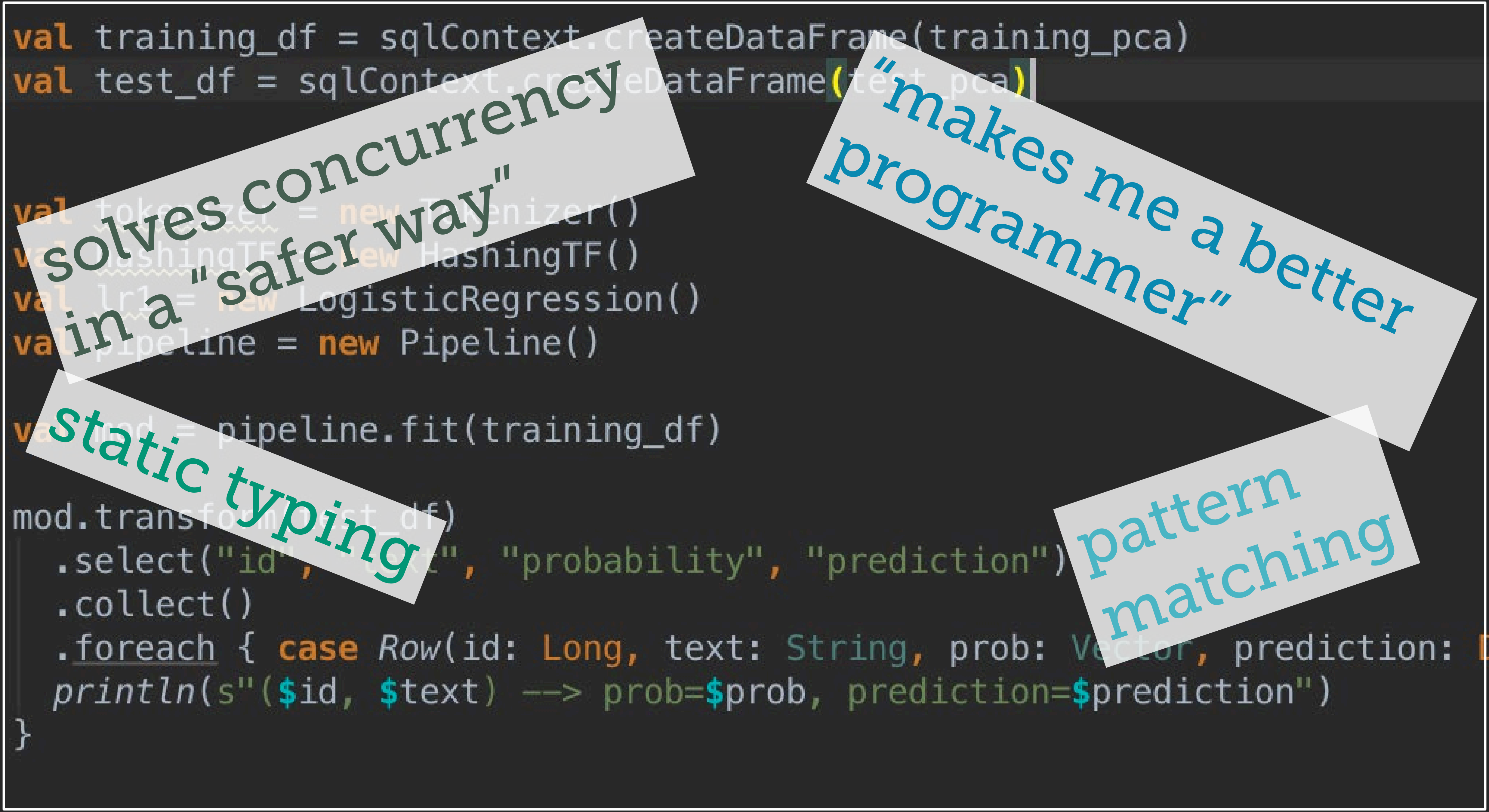
solves concurrency in a "safer way"

static typing

pattern matching



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solves concurrency in a "safer way"

"makes me a better programmer"

static typing

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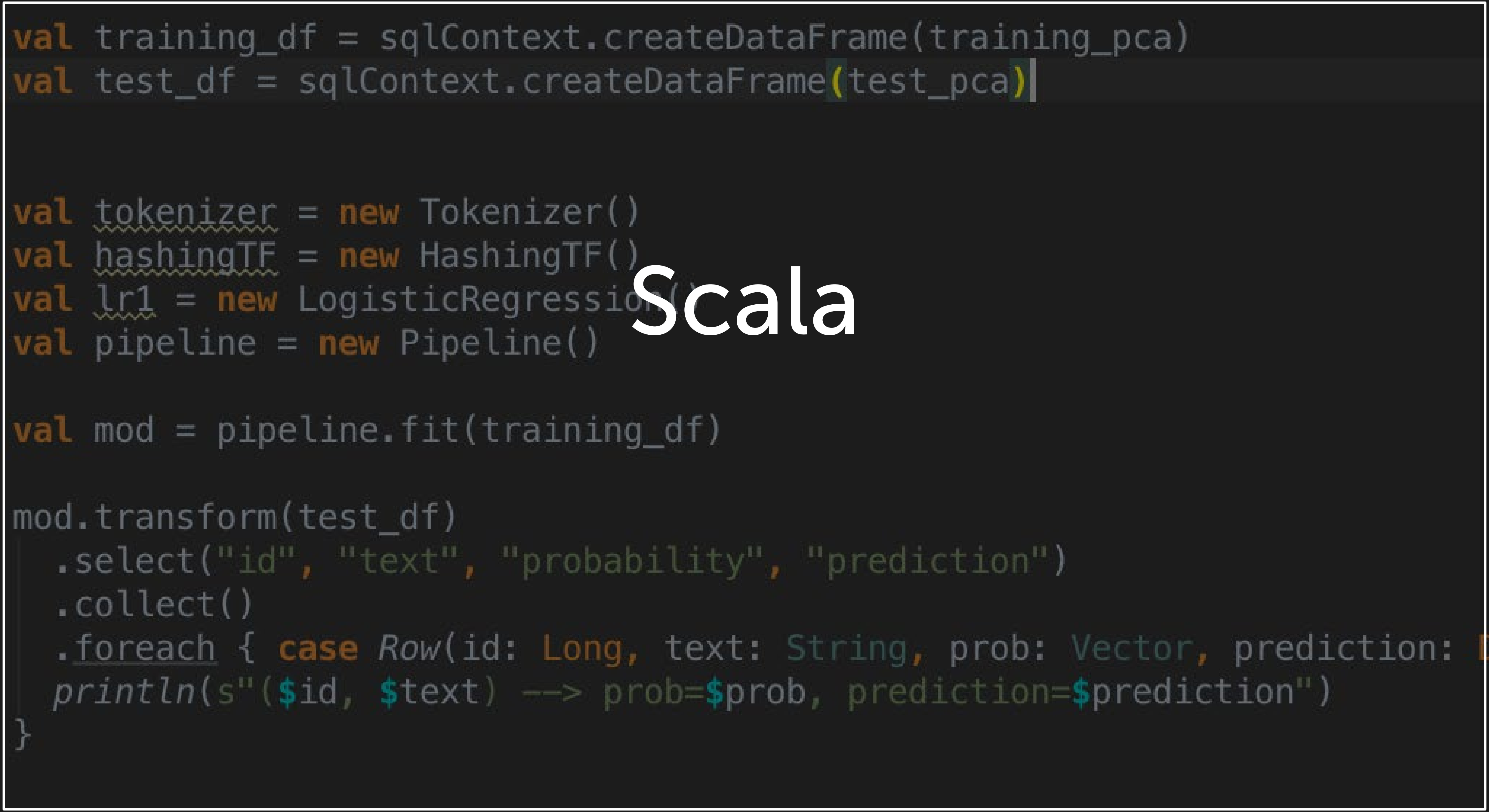
Scala



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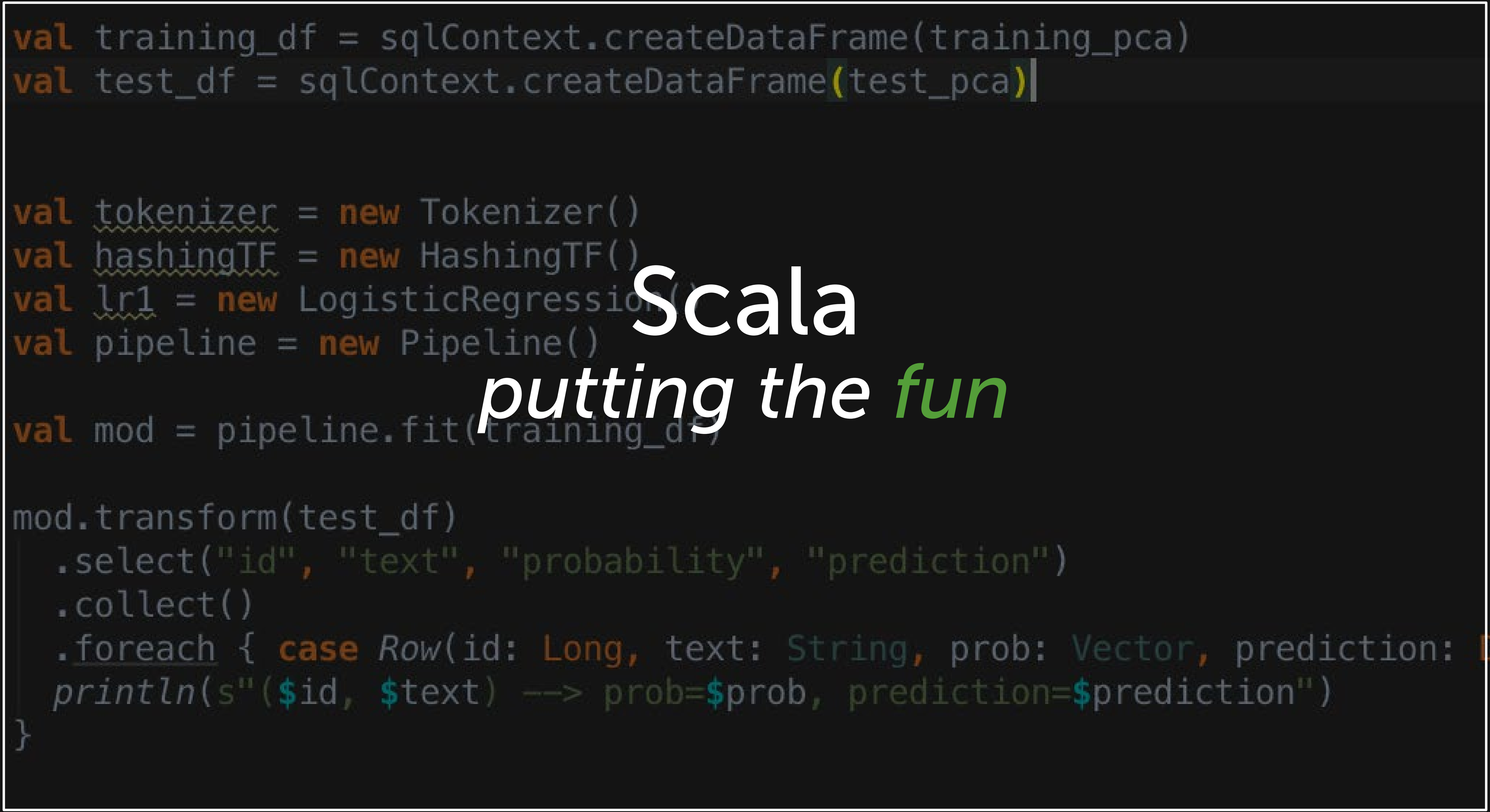
Scala

putting the fun



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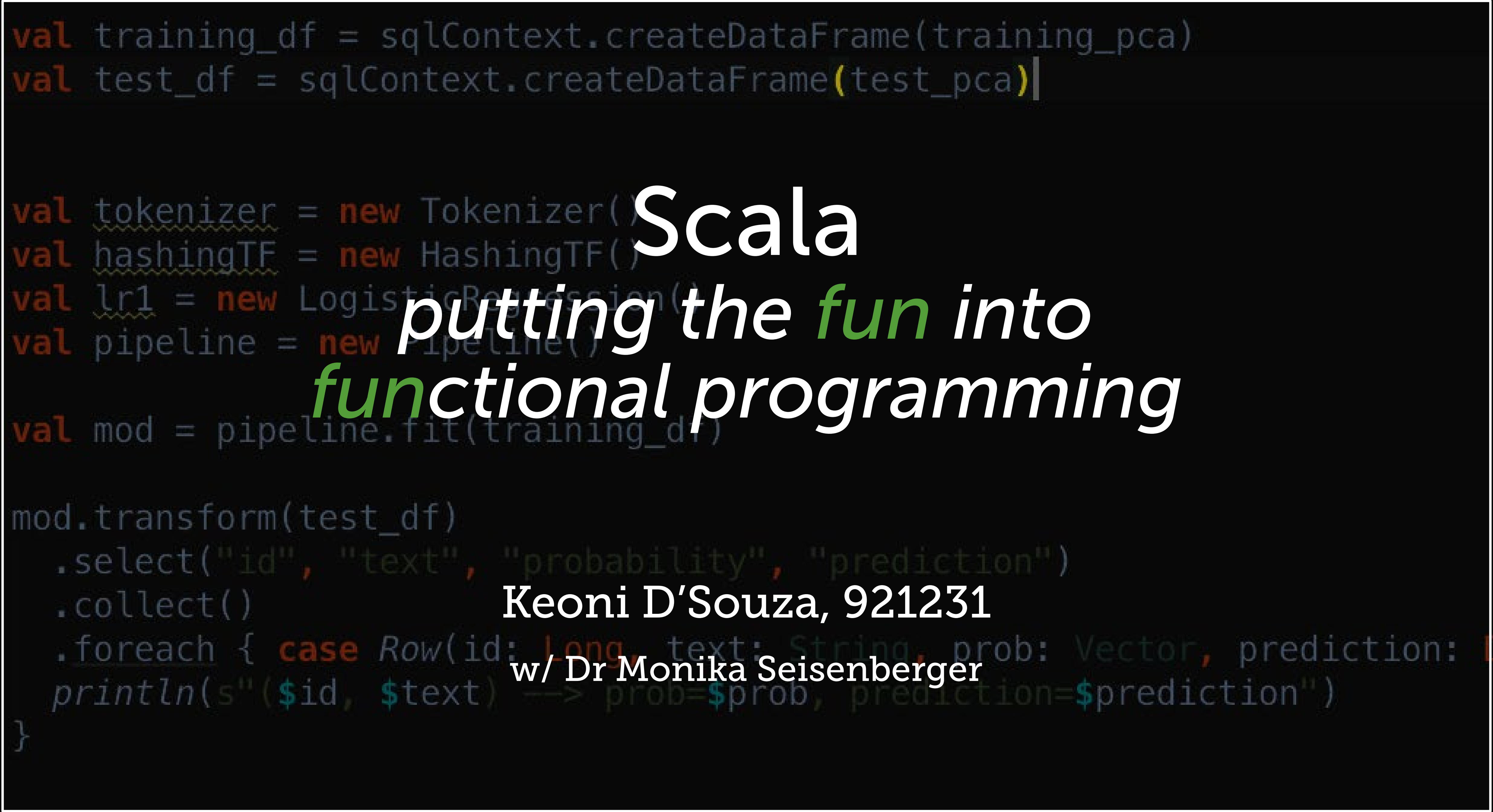
Scala

putting the fun into functional programming

Keoni D'Souza, 921231

w/ Dr Monika Seisenberger



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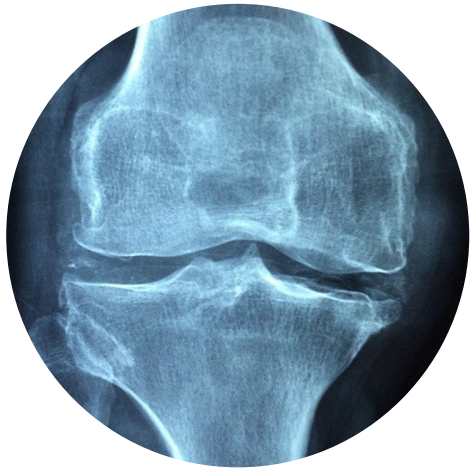


Benvenuto/a!

Willkommen!

Добро пожаловать!

Welcome!

Välkommen!

Bienvenue !

Croeso!

¡Bienvenido/a!

Witaj!

Selamat datang!

Bem-vindo/a!

Hoş geldin!

Benvenuto/a!

Willkommen!

Добро пожаловать!

Välkomn

[APPLAUSE]

venue !

Wi

/a!

Selamat datang!

Bem-vindo/a!

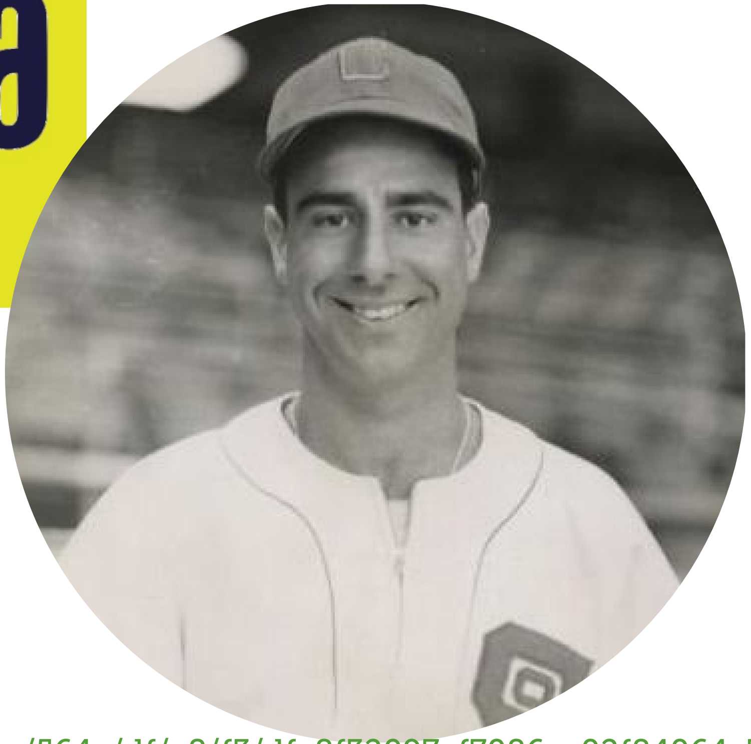
Hoş geldin!

WHAT ARE YOU HERE TO TALK ABOUT TODAY?

What are you here to talk about today?

PC: https://upload.wikimedia.org/wikipedia/en/a/a2/Scala_Radio.svg

What are you here to talk about today?



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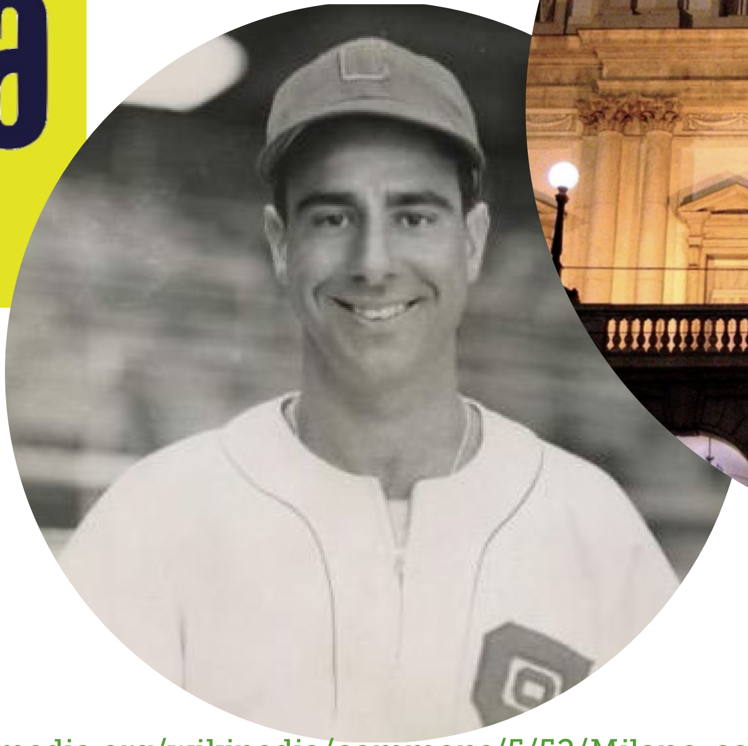

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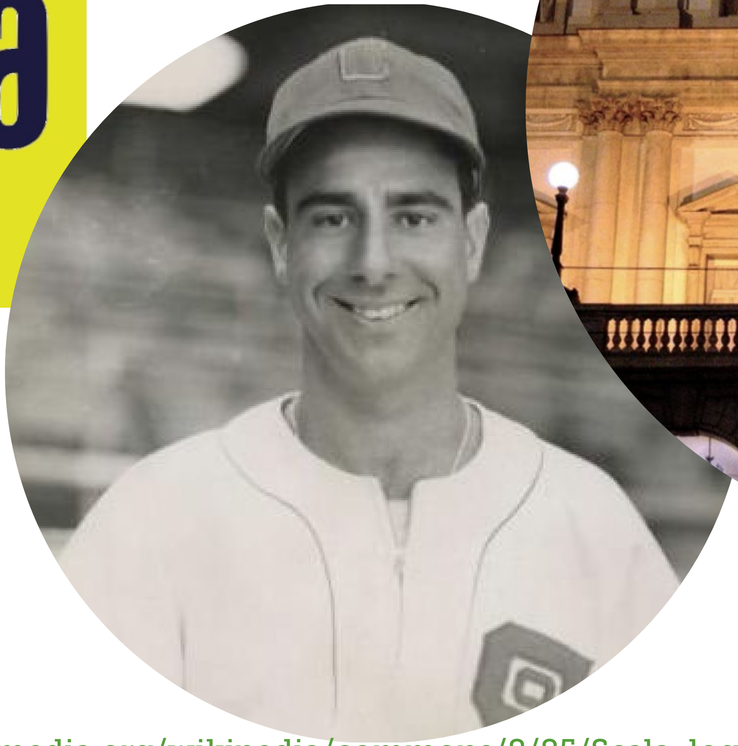
What are you here to talk about today?

scala RADIO

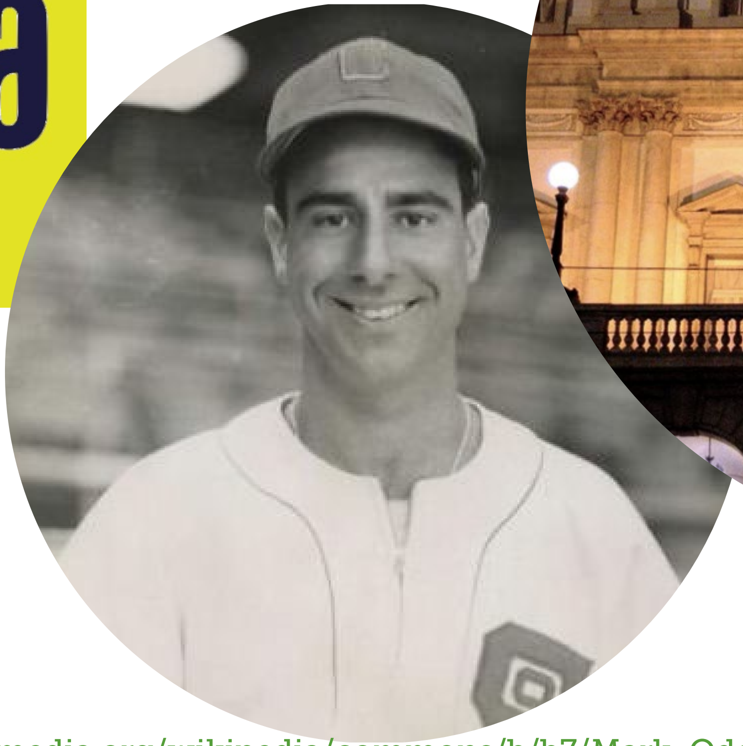


Scala

PC: https://upload.wikimedia.org/wikipedia/commons/8/85/Scala_logo.png

What are you here to talk about today?

scala
RADIO



Scala

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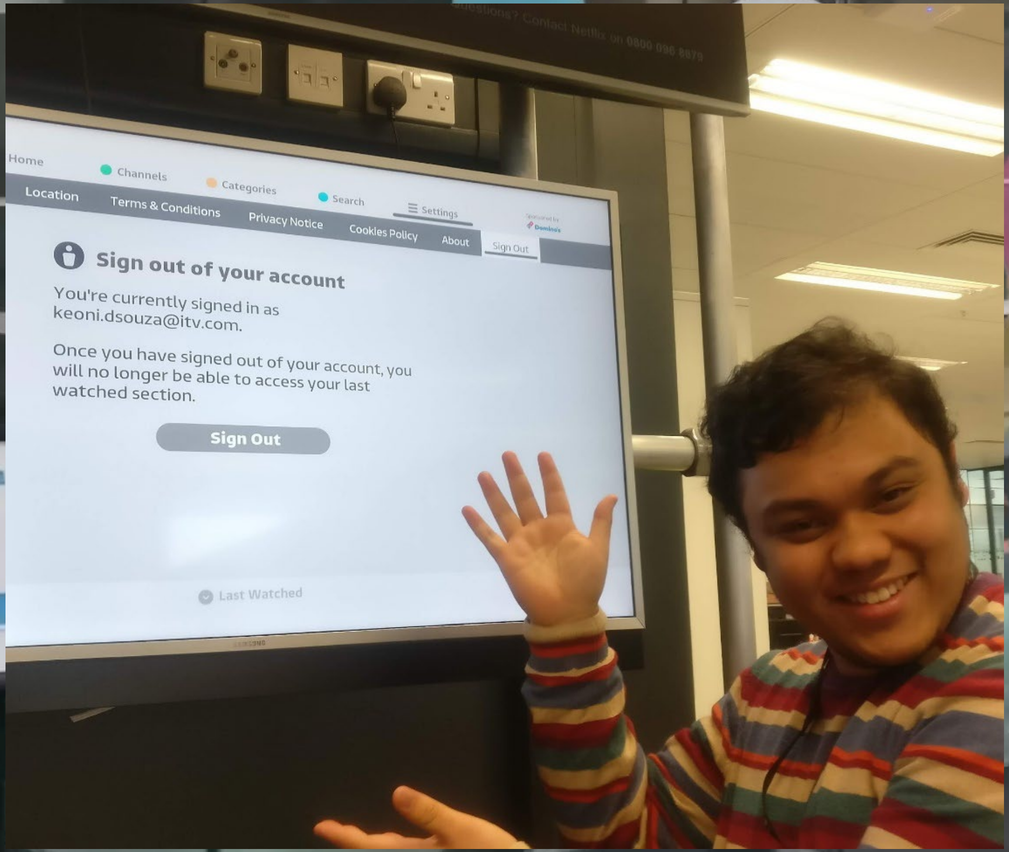
WHY ARE YOU HERE?

WHY ARE YOU HERE?

Project motivations

Why are you here?

Project motivations


Home
Channels
Categories
Search
Settings
Location
Terms & Conditions
Privacy Notice
Cookies Policy
About
Sign Out
Sign out of your account
You're currently signed in as keoni.dsouza@itv.com.
Once you have signed out of your account, you will no longer be able to access your last watched section.
Sign Out
Last Watched

- My time at ITV
  - Liking Scala there
  - Wondering how it compares to Haskell
  - Understanding FP more

Why are you here?

Project motivations

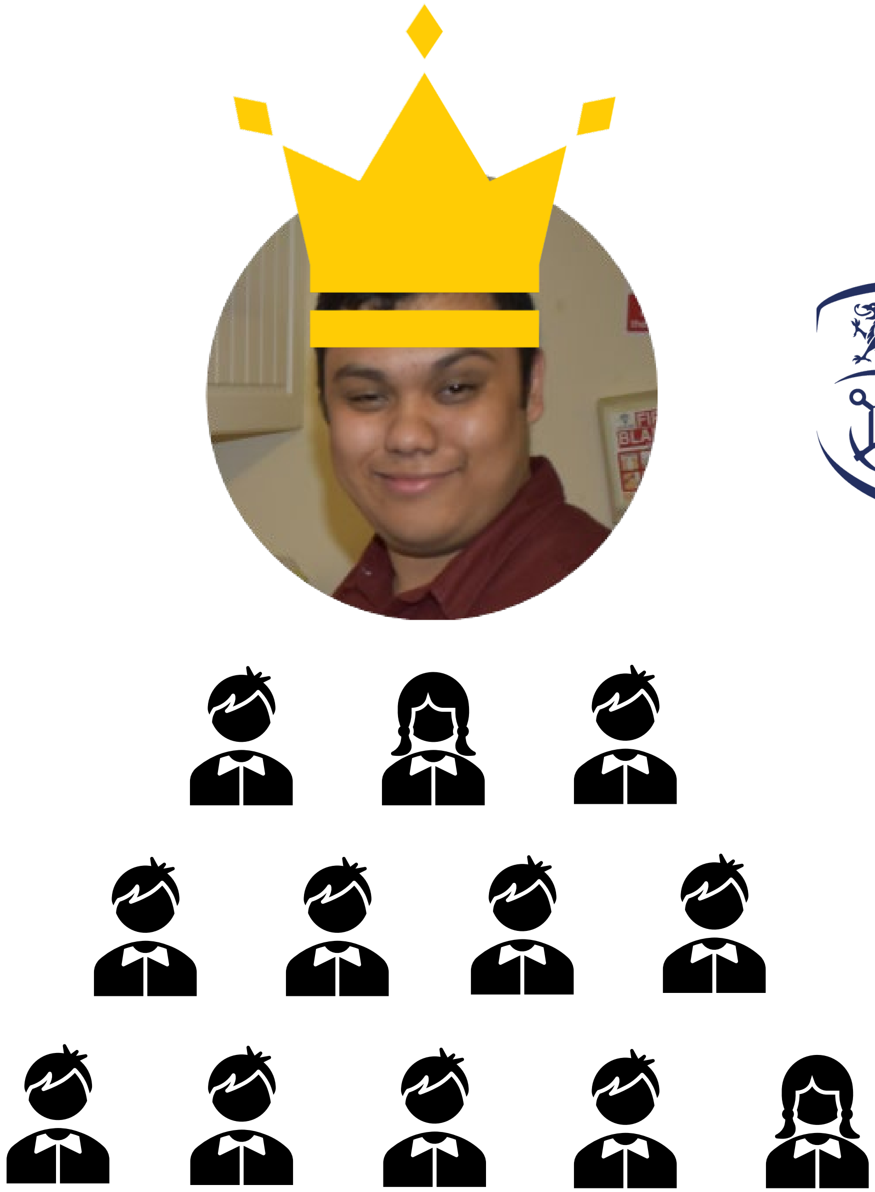
You're currently signed in as keoni.dsouza@itv.com.

Once you have signed out of will no longer be able to acc watched section.

IMP RTANT!

compares to Haskell

- Understanding FP more



Swansea University
Prifysgol Abertawe

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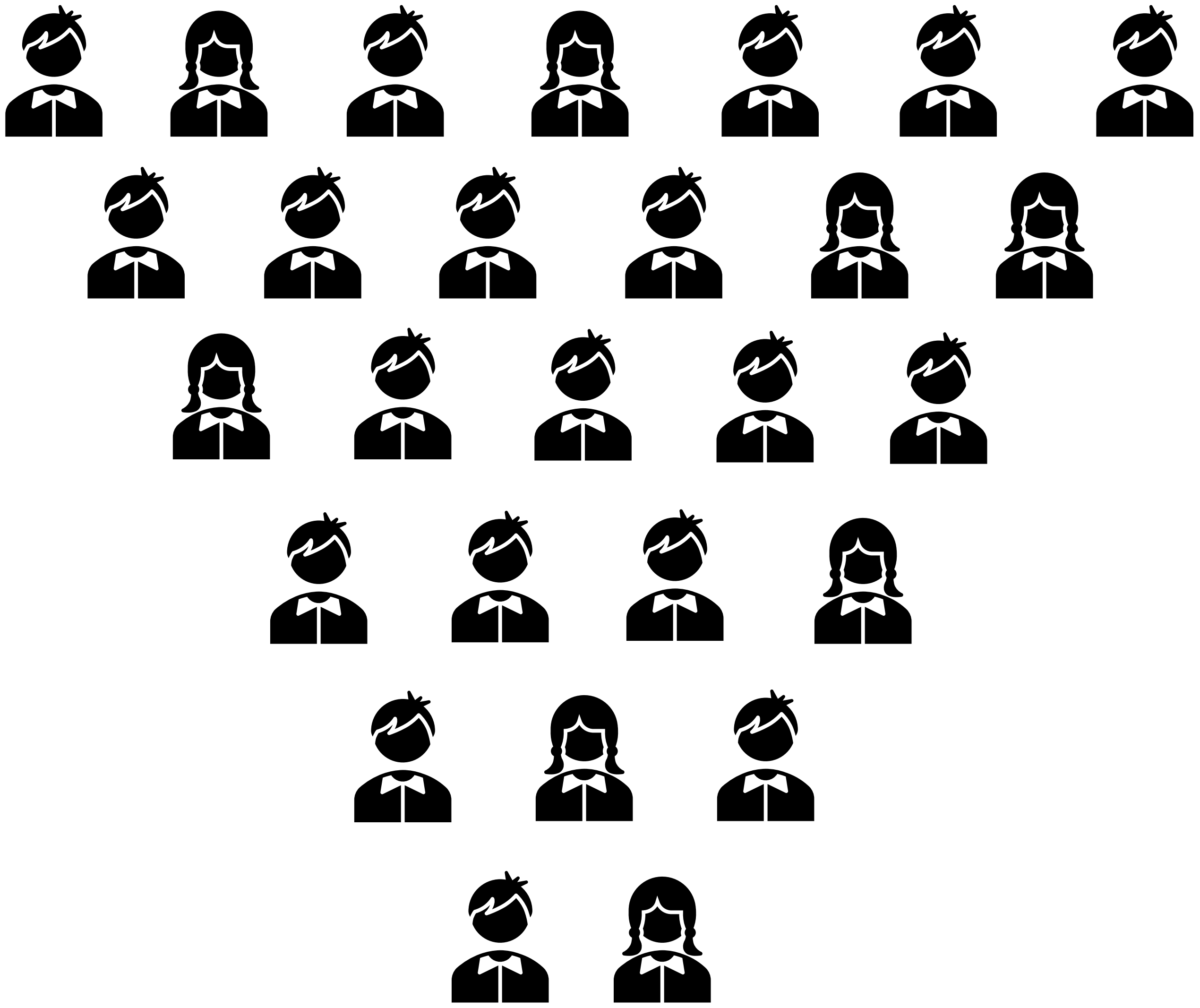

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WHAT EVEN *IS* SCALA?

WHAT EVEN *IS* SCALA?

Background on the language

What even is Scala?

Background on the language

- Scala (**sca**lable **la**nguage)
  - small to the big
- Not a Java extension
  - Interoperability
  - Basic operators, data types and control structures shared
- Tail call recursion optimisation
  - Compiles faster than Java

What even is Scala?

Background on the language

- Design started in 2001 at EPFL
- Better ways than Java
- Providing an alternative
- Precursors:
  - Pizza – moderately successful
  - Funnel – too academic
- First public release: 2003
- Scala v2.0: 2016

SHOW ME THE GOOD STUFF…

SHOW ME THE GOOD STUFF…

Programming functionally in Scala

Functions

- Function: a group of statements performing a task
- Scala has both functions and methods:
  - Method: part of a class with a name, type signature, perhaps some annotations
  - Function: complete object that can be assigned to a variable
  - *In other words, a function that's defined as a member of some object is called a method.*

[1] "Scala – Functions – Tutorialspoint". [https://www.tutorialspoint.com/scala/scala_functions.htm]. Accessed October 2019.

Functions

- Functions are declared in the following form:

```
def functionName ([list of parameters]): [return type]
```

[1] "Scala – Functions – Tutorialspoint". [https://www.tutorialspoint.com/scala/scala_functions.htm]. Accessed October 2019.

Functions

- Functions are defined in the following form:

```
def functionName ([list of parameters]): [return type] = {
  function body
  return [expr]
}
```

- The return type could be any valid Scala data type and the parameter list will be a collection of variables separated by commas (both are optional).

[1] “Scala – Functions – Tutorialspoint”. [https://www.tutorialspoint.com/scala/scala_functions.htm]. Accessed October 2019.

Functions

```
object add {
  def addInt(a: Int, b: Int): Int = {
    var sum: Int = 0
    sum = a + b
    return sum
  }
}
```

[1] “Scala – Functions – Tutorialspoint”. [https://www.tutorialspoint.com/scala/scala_functions.htm]. Accessed October 2019.

Functions

```
object add {
  def addInt(a: Int, b: Int): Int = {
    var sum: Int = a + b
    return sum
  }
}
```

Functions

```scala
object add {
  def addInt(a: Int, b: Int): Int = {
    return a + b
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Functions

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object add {
  def addInt(a: Int, b: Int): Int = return a + b
}
```

Functions

```scala
object add {
  def addInt(a: Int, b: Int): Int = a + b
}
```

- Even cleaner!
- You don't even need the return keyword – the last value is automatically returned!
- Semicolons and braces are not always required.

Functions

- How would we write a function to calculate the square of a number?

Functions

- How would we write a function to calculate the square of a number?
- The math library has a built-in power function:

```
def pow(x: Double, y: Double): Double
```

where:

x is the base

y is the exponent

x^y is returned

that allows you to calculate the square easily:

```
scala.math.pow(n,2).
```

[2] “scala.Math”. [https://www.scala-lang.org/api/2.9.1/scala/Math$.html]. Accessed October 2019.

Functions

- But, how would we describe one manually?

Functions

- But, how would we describe one manually?

```scala
// square: Int -> Int
def square(n: Int): Int = n * n
```

- The type annotations (the parts after the colons) don't necessarily have to be included because of Scala's built-in type inference.

Functions

- Functions that don’t return anything are called procedures.
  - It doesn’t actually return nothing – it returns a `Unit`, which is equivalent to Java’s `void`.

```
object Hello {
  def printMe(): Unit = {
    println("Hello, Scala!")
  }
}
```

[1] “Scala – Functions – Tutorialspoint”. [https://www.tutorialspoint.com/scala/scala_functions.htm]. Accessed October 2019.

- What does this function do?

```
def iAmAFunction() = {
  val name = scala.io.StdIn.readLine("Please enter
your name: ")
  println("Congratulations, " + name + " — you have
been called to learn Scala!)
}
```

Reading user input

- The `io.StdIn` library stands for standard input, allowing users to communicate with the keyboard and interact with Scala functions.
- What does this function do?

```
def iAmAFunction() = {
  val name=scala.io.StdIn.readLine("Please enter your
name: ")
  println("Congratulations, " + name + " – you have
been called to learn Scala!)
}
```

Lists

mutable

immutable

Lists

mutability

you can change stuff

immutable

Lists

mutability	immutability
you can change stuff	stuff stays the same

Lists

mutability

you can change stuff

`ListBuffer`

immutability

stuff stays the same

Lists

mutability

you can change stuff

`ListBuffer`

immutability

stuff stays the same

`List`

```scala
import scala.collection.mutable.ListBuffer
```

Lists

- Creating a new ListBuffer instance:

```scala
var breads = new ListBuffer[String]()
```

```scala
import scala.collection.mutable.ListBuffer
```

Lists

- Adding to a ListBuffer instance:

```scala
breads += "Bagel"

breads ++= List("Baguette",
                "Boule",
                "Brioche")
```

```scala
import scala.collection.mutable.ListBuffer
```

Lists

- Combine the two!

```scala
var breads: ListBuffer[String] =
  ListBuffer("Bagel",
             "Baguette",
             "Boule",
             "Brioche")
```

```scala
import scala.collection.mutable.ListBuffer
```

Lists

- Removing from a ListBuffer instance:

```scala
breads -= "Brioche"
```

```
import scala.collection.mutable.ListBuffer
```

Lists

- Also:

```
breads remove 0 // the same as
                   breads.remove(0)
```

- Here, we’re using postfix notation for `remove( )` instead of brackets.
- The number refers to the position in the ListBuffer.

List operations

- `anyList.head` returns the first element
- `anyList.tail` returns the list minus the first element
- `anyList.isEmpty` returns a Boolean asking if the list is empty

Collection operations: `map`

```scala
val stringNums = List("1", "2", "3")
val ints = stringNums.map(s => s.toInt)
```

- The `map` operation takes a predicate and applies it to every element contained within the collection.
- It’s part of the `TraversableLike` trait, so will work on all different types of collections.
- In this example, for each `s` it applies the `toInt` function to convert it into an integer.

Collection operations: `filter`

```
val evens = stringNums.map(s => s.toInt).filter(_ % 2 == 0)
```

- The `filter` operation takes a predicate that returns a Boolean.
- If an element evaluates to true, it is returned. Falsely evaluated items are filtered out of the result.
- In this example, even numbers are returned. The underscore (_) symbol (wildcard) represents, in each case, the evaluated element.

Collection operations: `map`

- We can streamline the `map` predicate with the `_`.

```
val ints = stringNums.map(s => s.toInt)
val ints = stringNums.map(_.toInt)
```

Collection operations: flatten

```
val couples = List(
                   List(“Keoni", “Louis"),
                   List(“Richard", “Per"))
val people = couples.flatten
```

Collection operations: `flatten`

```
val pairs = List(List(“Keoni", “Louis"), List(“Richard", “Per"))
val people = couples.flatten
```

- The `flatten` operation takes a collection of n dimensions and squashes it into $n - 1$ dimensions.
- It works, from the lowest degree, with two-dimension collections or higher.
- In this example, the pairs in `pairs` are flattened into an array containing all the peoples’ names. Compare the 2-dimensional `couples` with the 1-dimensional `people`.

Collection operations: `flatmap`

- `flatmap` combines the `flatten` and `map` operations.

```
val pairs  = List(List("Keoni", "Louis"),
                  List("Richard", "Per"))
val people = couples.flatmap(_ + " Herrey")
```

- It is syntactic sugar for:

```
val people = couples.flatten.map(_ + " Herrey")
```

- In this example, for each person it adds the same surname.

PC: https://i.pinimg.com/736x/d1/12/84/d11284f737250fb1332fc2cb2ab41404--eurovision-songs-mormons.jpg

WILL THIS WORK FOR PEOPLE LIKE US?

WILL THIS WORK FOR PEOPLE LIKE US?

Teaching Scala to students

Will this work for people like us?

Teaching Scala to students

- Multi-paradigm – there's leeway
- Elegant – you can write beautiful code
- You could earn, on average, £85,000
- Big companies use the language
- Second most in-demand in 2019 (8.5 interviews offered over a 2-6-week period (from recruitment firm Hired)

IS THAT IT?

Rounding off the presentation

PC: https://i.kym-cdn.com/entries/icons/facebook/000/028/776/cover5.jpg

That's it from me – for now…!

1

Part I/ Writing and reading in Scala

2

Part II/ Lists and higher order functions in Scala

3

Part III/ Interacting Scala with Java

Lab time! Log in and go to keonidsouza.com/scala