Chair III: Database Systems, Professorship of Data Mining and Analytics
Chair XXV: Data Science and Engineering
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The Power of SQL Lambda Functions

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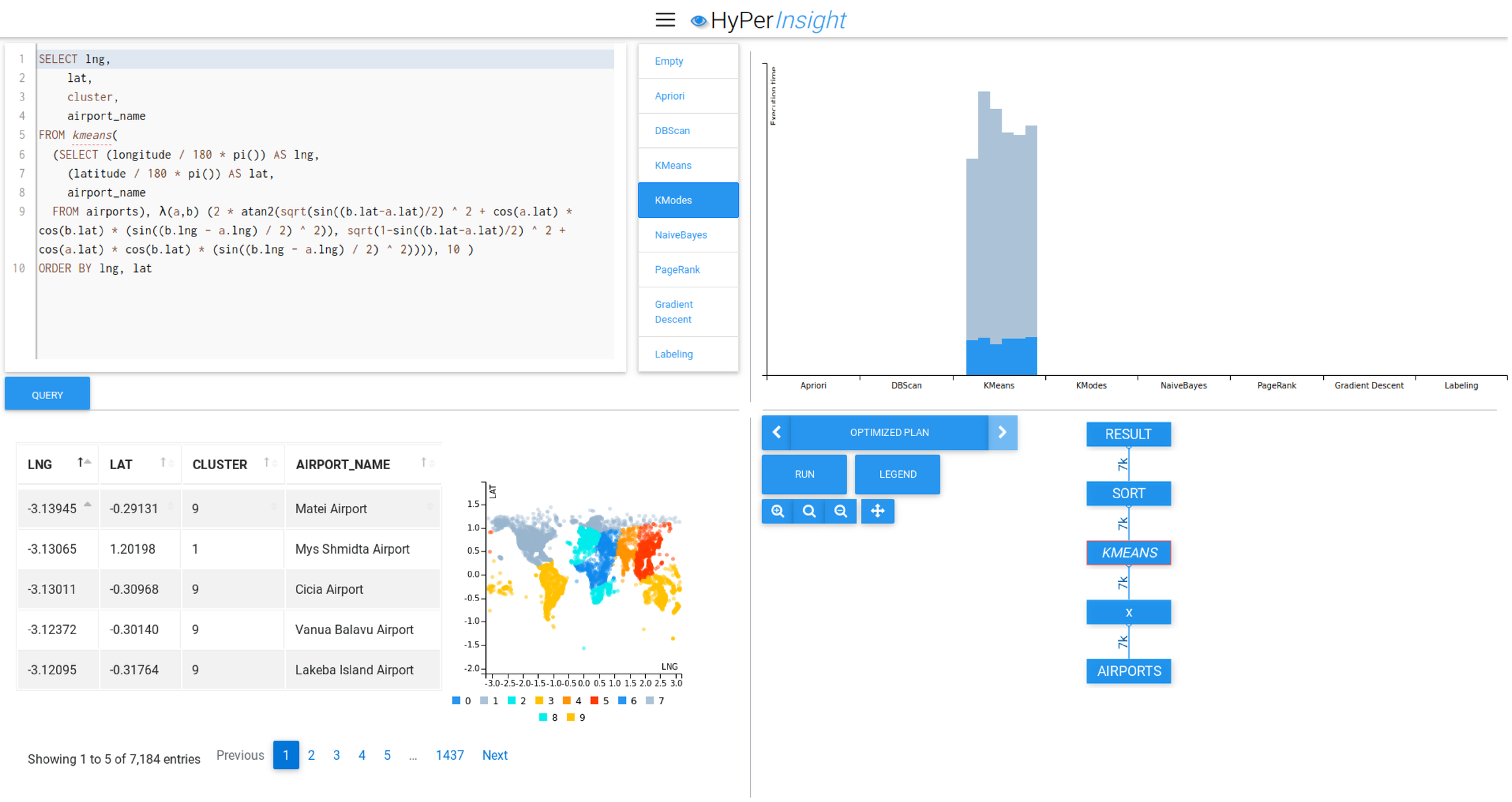
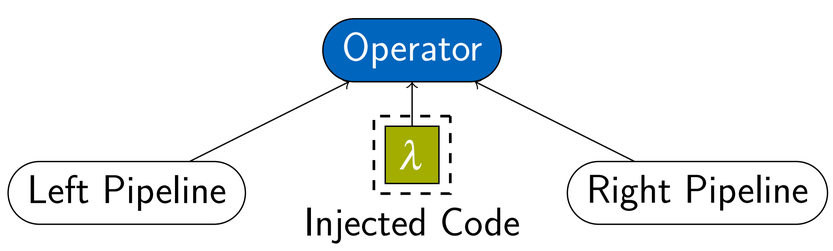
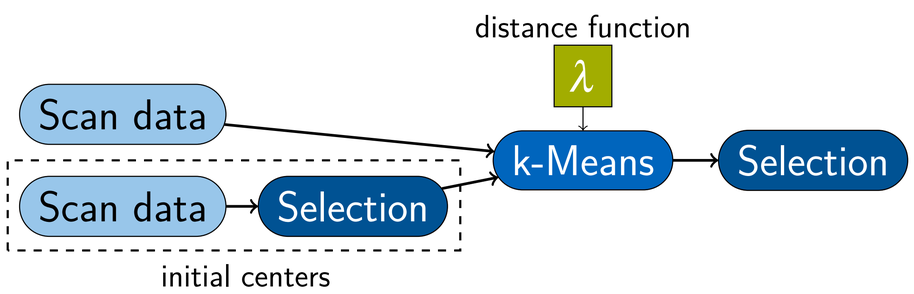


Lambda Functions for SQL



+ Allow users to inject expressions in operators
+ Applicable on unary and binary operators as well

Example: k-Means



+ Distance function as lambda expression
+ User-specified distance functions are allowed

```
CREATE TABLE data(x FLOAT, y INT);
CREATE TABLE center(x FLOAT, y INT);
INSERT INTO ...

SELECT * FROM kmeans(
  (SELECT x,y FROM data),
  (SELECT x,y FROM center),
  -- the distance function
  λ(a,b) (a.x-b.x)^2+(a.y-b.y)^2,
  3 -- max. number of iterations
);
```

Listing 1: k-Means.

```
CREATE TABLE edges (a BIGINT,b BIGINT);
INSERT INTO ...



SELECT * FROM pagerank(
   (SELECT * FROM edges),
   λ(src) src.a, -- source
   λ(dst) dst.b, -- destination
   0.85,     -- damping factor
   0.00001, -- threshold
   100       -- iterations
);
```

Listing 2: PageRank.

```
CREATE TABLE data (x FLOAT, y FLOAT);
CREATE TABLE weights(a FLOAT, b FLOAT);
INSERT INTO ...

SELECT * FROM gradientdescent(
  -- the loss function
  λ(d,w) (w.a*d.x+w.b-d.y)^2,
  -- training data set
  (SELECT x,y FROM data d),
  -- initial weights
  (SELECT a,b FROM weights w),
  0.05, -- learning rate
  100    -- max. number of iteration
);
```

Listing 3: Gradient descent.

```
CREATE TABLE testdata (x FLOAT);
CREATE TABLE weights(a FLOAT, b FLOAT);
INSERT INTO ...



SELECT * FROM labeling(
  -- the model function
  λ(d,w) (w.a*d.x+w.b),
  -- test data set
  (SELECT x,y FROM testdata d),
  -- optimized weights
  (SELECT a,b FROM weights w)
);
```

Listing 4: Labeling.

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