Timelines

Design Document

CMPT371-Team2

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Architecture

Working from a high level downwards; the architecture is Model-View-Controller as required by React. The view component is handled entirely by React. The controller will be handled by internally developed React components and a pipes-and-filters entry point into the system. Finally, the model is handled by a blackboard sub-architecture.

The pipes and filters design will be useful when the data first enters the system and is streamlined through the Parser class which handles all formatting, determining data types and creating the timeline. The blackboard design pattern is responsible for the core functionality of the system once the entering data has been handled. The blackboard design's strength is in decoupling the functionality and the memory.

The blackboard design pattern traditionally has three components: blackboard, knowledge source, and control component. The control component is the Filter class as it determines which data is drawn and how. It accomplishes this by working in tandem with the Column and Draw classes. The blackboard component is the Timeline class as it stores all of the current data. The Column class is the knowledge source as it stores the information about how the data in question will be represented.

The Parser handles all of the logic of a pipes-and-filters design pattern, however, it is possible that this class will be divided in the future if we determine the class cuts across too many concerns.

Strength of architecture:

Pipes-and-filters entry point: Modularity of data import process. The pipes-and-filters encapsulates all of the logic of pre-processing the data while allowing for future concurrency extensionality.

Blackboard data-control: This was chosen due to a specific technical constraint in JavaScript where data cannot be passed by reference. Blackboard allows us to address the concern of efficiency, in both memory management, and speed because we're using a single global array for each dataset.

Main Classes:

Parser

The data handler class, acts as an entry point for data into the system. It is responsible for taking in a .csv file, sorting it, inferring the type of the data, and defining the allowable draw methods. Then responsible for instantiating a timeline, and populating it with Column classes.

In the future this class will include the functionality to upload a .tl (timeline) file and reconstructing a previous workspace.

Fields:

prompt: a string that's the prompt for the user

fileType: a filetype object, which is seen as acceptable by the parser

Methods:

constructor(props: ParserInterface):

isValid :: event → boolean

Pre-conditions: no other parser object exists

Post-conditions: a parser object is instantiated as the only parser object

Inputs: the js event passed in by the html file input

Output: a boolean indicating success or failure

Side Effects: array of data objects flagged as valid, or invalid

sortData :: Array<object> → boolean

Pre-conditions: a csv has been uploaded, and the data is stored in an array

Post-conditions: the data stored in the array is sorted by some date column

Inputs: array of data

Output: a boolean indicating success or failure

Side-effects: the array of data sorted by a time field

inferTypes :: Array<object> → Array<Column>

Pre-conditions: An array of sorted data exists for types to be inferred from

Post-conditions: The array is transformed into an array of type Column, and the default behavior for the data is inferred and set

Inputs: array of data

Output: a list of objects which define the methods available for the data

Side-effects: None

parse :: fileEvent → Array<Data>

Pre-conditions: The user uploads a file

Post-conditions: The data is read out of the csv file and put into an array object

Inputs: the js event passed in by the html file input

Output: a CSVData object

Side-effects: None

parseCSV :: fileEvent → Array<Data>

Pre-conditions: The user has uploaded a csv file

Post-conditions: The data from the file is stored in a global array

Inputs: a .csv file

Output: an array of data objects

Side Effects: The creation of a timeline, it's associated columns

parseTL :: fileEvent → void

Pre-conditions: The user has uploaded a timeline config file

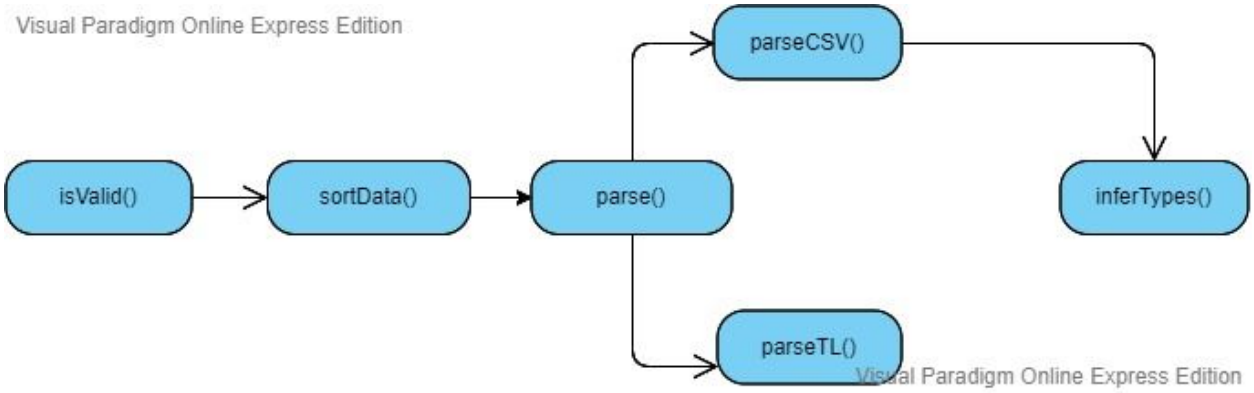
Post-conditions: The workspace associated with that file is restored as it was when the user saved.

Inputs: a .tl file

Output: None

Side-effects: The workspace is fully instantiated

Flow of Parser Diagram



Column

The class responsible for a single column of data within a timeline.

Fields:

yScale: float which corresponds to the y scaling for data being drawn

key: a string descriptor of the column name which will be drawn

primType: a string descriptor of the type that column is associated with

definedDrawList: a list of draw objects which are defined for the type of data the column represents

Methods:

constructor (float: yScale, Array<Draw>: definedDrawList, string: key, string: primType)

show :: void → void

Pre-conditions: A .csv file has been uploaded and there exists data for a column to be created from

Post-conditions: A column class is created

Inputs: none

Outputs: none

Side-effects: Renders a column of data to the canvas

rescale :: float → void

Pre-conditions: The column is populated with data

Post-conditions: The y scale of the column is changed

Inputs: a float which is the new scaling factor

Outputs: none

Side-effects: Causes the column to be rendered at a new scale

Data

Class responsible for actually storing the data from a .csv file.

Fields:

arrayOfData: an array of the actual data objects

filter: a filter object

pathToData: a string which stores the path to the .csv

currentXColumn: a string which is the label of the column currently being used by the active timeline as the X axis label

currentYColumn: a string which is the label of the column currently being used by the active timeline as the Y axis label

Methods:

constructor (string: pathToData, Array<Object>: arrayOfData, filter: filter)

getData :: void → Array<Object>

Pre-conditions: A file has been uploaded by a user

Post-conditions: A data class object is created

Inputs: none

Outputs: the arrayOfData

Side-effects: none

setData :: Array<Object> → void

Pre-conditions: None

Post-conditions: The Data object now holds an array of data

Inputs: an array of data to be stored by the object

Outputs: none

Side-effects: none

getFilter :: void → filter

Pre-conditions: The data class as a reference to a filter object

Post-conditions: A reference to the filter object is returned

Inputs: none

Outputs: A reference to the filter object for a dataset

Side-effects: none

setPath :: string → void

Pre-conditions: None

Post-conditions: The data object is associated with a valid path name

Inputs: A string, which is a fully validated path name to where the data sits on the users computer.

Outputs: None

Side-effects: None

getPath :: void → string

Pre-conditions: The pathToData value has been set

Post-conditions: The pathToData value is returned

Inputs: None

Outputs: A string, which is a fully validated path name to where the data sits on the users computer.

Side-effects: None

Draw

Class responsible for storing the actual draw methods that column classes will use as rules to render themselves. This is really just a wrapper for a function, and the function name.

Fields:

drawFunction: a reference to a function that the column uses to actually render itself

functionDesc: a string which is the 'pretty printed' version of the function name, for rendering in dropdown menus.

Methods:

constructor (function(any → void) : drawFunction, string: functionDesc)

getDrawName :: void → string

Pre-conditions: The name of the function is set

Post-conditions: The name of the function is returned

Inputs: none

Outputs: returns a descriptive string for the draw function that the object is associated with

Side-effects: none

getDrawFunction :: void → function(any → void)

Pre-conditions: The object has an associated function

Post-conditions: The function object is returned

Inputs: none

Outputs: returns a reference to the drawFunction function

Side-effects: none

Predicate

Wrapper class for predicates to be used by the filter class. This holds a reference to a string, and a well-formed predicate (a function which returns true or false for a singular element).

Fields:

name: string

predicate: function: any → boolean

Methods:

constructor (string: name, function(any → boolean))

getName :: void → string

Pre-conditions: The predicate name is set

Post-conditions: The predicate name is returned

Inputs: None

Outputs: A string, the name of the predicate

Side-effects: None

evaluate :: Object → bool

Pre-conditions: The predicate is defined, and the object being passed in is the correct type

Post-conditions: The predicate is evaluated with the passed in object and true or false returned depending on whether or not the predicate holds for that object

Inputs: The data point to evaluate if the predicate holds

Outputs: The result of the predicate function

Side-effects: None

Filter

Class responsible for storing the information about which data is drawn. By default it stores only information about the range that the data is drawn in. Optionally, it also filters the data by predicates, allowing the user to define things like “only data less than 5” or something similar.

Fields:

lowerRange: integer

upperRange: integer

isShown: a boolean which determines if a given column is actually being drawn

listOfPreds: a list of predicate objects

Methods:

constructor(integer: lowerRange, integer: upperRange, boolean: isShown)

redefineRange :: (integer, integer) → void

Pre-conditions: None

Post-conditions: A filter object is created

Inputs: new lower_range and upper_range

Outputs: none

Side-effects: the lower_range, and upper_range values are reassigned

addPredicate :: predicate → void

Pre-conditions: None

Post-conditions: The predicate is added to the list of predicates and this is immediately applied to the current render

Inputs: a well formed, named predicate which relates to the data

Outputs: none

Side-effects: the new predicate is appended to the list of predicates

removePredicate :: string → void

Pre-conditions: The predicate list is non-empty

Post-conditions: The specified predicate is removed from the list. If no such predicate exists nothing is removed.

Inputs: the name of a specific predicate to remove

Outputs: none

Side-effects: the indexed predicate is removed from the list

getAllPreds :: void → Array<predicate>

Pre-conditions: None

Post-conditions: Returns a list of all of the predicates currently in the filter object. If the list is empty, the empty list is returned

Inputs: none

Outputs: listOfPreds, a list of key value pairs

Side-effects: none

toggleFilter :: filter → void

Pre-conditions: None

Post-conditions: The is shown variable is switched to whatever it wasn't

Inputs: the filter being toggled

Outputs: none

Side-effects: Sets isShown to *not* isShown

Timeline

Container class for columns. Its draw method simply calls the draw method of all of the columns associated with it.

Fields:

listOfColumns: list of objects of type Column class

isShown: a boolean. True if data is shown.

bigDataArray: array of the input data from the .csv

Methods:

constructor(Array<Column> : listOfColumns)

The constructor for the class takes in an array of all of the data. It then uses the data to populate its own internal list of columns, and by default sets its own 'isShown' variable to true.

show :: void → void

Pre-conditions: There's something to show

Post-conditions:

Inputs: none

Outputs: none

Side-effects: calls the show method on all of the Columns in listOfColumns

toggleVisibility :: void → void

Pre-conditions: There's something to draw

Post-conditions: The is shown variable is notted

Inputs: none

Outputs: none

Side-effects: sets isShown to *not* isShown.

Top Level Functions

This part of the document outlines the main, purely functional components of the program. These functions were included to support a pseudo functional style, where each timeline only has access to it's defined functions, that way it's easier to reason about correctness when debugging any rendering aspects of the code.

drawIntervalData :: (Data, Filter, float) → void

A function which takes in a data set, and draws it to the canvas as Interval Data.

Pre-Conditions:

A data set exists which can be drawn as either interval data, or quantified interval data.

Post-Conditions:

The data set is drawn, as interval data, to the canvas.

Parameters:

data: A reference to the data set to be drawn

filter: A reference to the filter which determines which data will be drawn

yScale: A float which represents the scale at which the data is to be drawn.

drawQuantifiedIntervalData :: (Data, Filter, float) → void

A function which takes in a data set, and draws it to the canvas as as quantified interval data.

Pre-Conditions:

A data set exists which can be drawn as quantified interval data

Post-Conditions:

The data set is drawn, as interval data, to the canvas.

Parameters:

data: A reference to the data set to be drawn

filter: A reference to the filter which determines which data will be drawn

yScale: A float which represents the scale at which the data is to be drawn.

drawPointData :: (Data, Filter, float) → void

A function which takes in a data set, and draws it to the canvas as a series of points data.

Pre-Conditions:

A data set exists which can be drawn as quantified interval data

Post-Conditions:

The data set is drawn, as interval data, to the canvas.

Parameters:

data: A reference to the data set to be drawn

filter: A reference to the filter which determines which data will be drawn

yScale: A float which represents the scale at which the data is to be drawn.

drawQuantifiedPointData :: (Data, Filter, float, boolean) → void

A function which takes in a data set, and draws it to the canvas as as quantified point data.

Pre-Conditions:

A data set exists which can be drawn as quantified interval data

Post-Conditions:

The data set is drawn, as interval data, to the canvas.

Parameters:

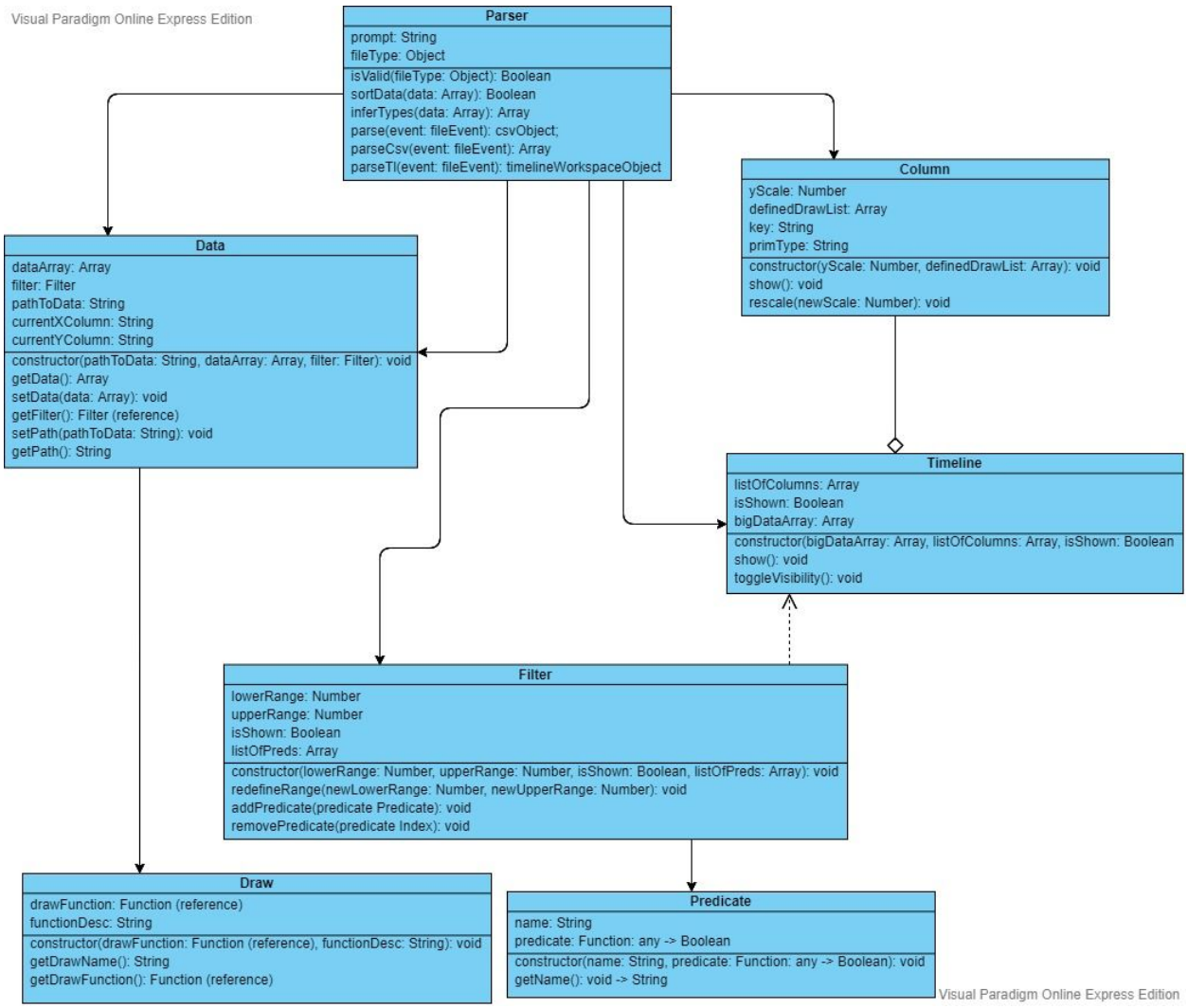
data: A reference to the data set to be drawn

filter: A reference to the filter which determines which data will be drawn

yScale: A float which represents the scale at which the data is to be drawn.

connected: A boolean which specifies whether the data is to be connected with piecewise lines or not.

UML Diagram


Visual Paradigm Online Express Edition
Parser
prompt: String
fileType: Object
isValid(fileType: Object): Boolean
sortData(data: Array): Boolean
inferTypes(data: Array): Array
parse(event: fileEvent): csvObject;
parseCsv(event: fileEvent): Array
parseTl(event: fileEvent): timelineWorkspaceObject
Column
yScale: Number
definedDrawList: Array
key: String
primType: String
constructor(yScale: Number, definedDrawList: Array): void
show(): void
rescale(newScale: Number): void
Data
dataArray: Array
filter: Filter
pathToData: String
currentXColumn: String
currentYColumn: String
constructor(pathToData: String, dataArray: Array, filter: Filter): void
getData(): Array
setData(data: Array): void
getFilter(): Filter (reference)
setPath(pathToData: String): void
getPath(): String
Timeline
listOfColumns: Array
isShown: Boolean
bigDataArray: Array
constructor(bigDataArray: Array, listOfColumns: Array, isShown: Boolean
show(): void
toggleVisibility(): void
Filter
lowerRange: Number
upperRange: Number
isShown: Boolean
listOfPreds: Array
constructor(lowerRange: Number, upperRange: Number, isShown: Boolean, listOfPreds: Array): void
redefineRange(newLowerRange: Number, newUpperRange: Number): void
addPredicate(predicate Predicate): void
removePredicate(predicate Index): void
Draw
drawFunction: Function (reference)
functionDesc: String
constructor(drawFunction: Function (reference), functionDesc: String): void
getDrawName(): String
getDrawFunction(): Function (reference)
Predicate
name: String
predicate: Function: any -> Boolean
constructor(name: String, predicate: Function: any -> Boolean): void
getName(): void -> String
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