

DATA PROCESSING AND VALIDATION USING JAVASCRIPT

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Data Processing

- Basic manipulation and preparation of data using JavaScript for further analysis and visualization.
- Purpose of Data Processing is to focus on
 - *Find data*
 - *Filter data*
 - *Manage data collection*
 - *CRUD order (create, Read, Update and Delete)*

Data Processing Tasks

- Reading in Data
- Combining Data
- Summarizing data
- Iterating and reducing
- Working with strings
- Regular expressions
- Working with time
- Checking data assumptions

Reading in data

- The FileReader object lets web applications to read contents of files.
- It uses File or Blob objects to specify the file or data to be read.
- FileReader includes four methods for reading a file -
.readAsBinaryString (), *.readAsText()*, *.readAsDataURL()* and *.readAsArrayBuffer()*.
- Constructor: `var reader = new FileReader();`

FileReader example: The function below reads one file and displays some of the file's properties like – name, type and size.

```
10 function readSingleFile(evt) {  
11     var f = evt.target.files[0];  
12  
13     if (f) {  
14         var r = new FileReader();  
15         r.onload = function(e) {  
16             var contents = e.target.result;  
17             alert( "Got the file "  
18                 + "name: " + f.name + "n"  
19                 + "type: " + f.type + "n"  
20                 + "size: " + f.size + " bytesn"  
21             );  
22         }  
23         r.readAsText(f);  
24     } else {  
25         alert("Failed to load file");  
26     }  
27 }  
28  
29 document.getElementById('fileinput').addEventListener('change', readSingleFile, false);  
30 </script>
```

Combining Data

- Sometimes, combination of data sets is required because they contain complementary information.
- Different ways of Combining or *merging* data :
 - *Combine data sets by one or more common attributes*
 - *Add together rows from different data sets*
 - *Combine attributes from different data sets*

Combine data sets by one or more common attributes

Data set 1



Data set 2



Combined data set

(Continuing)

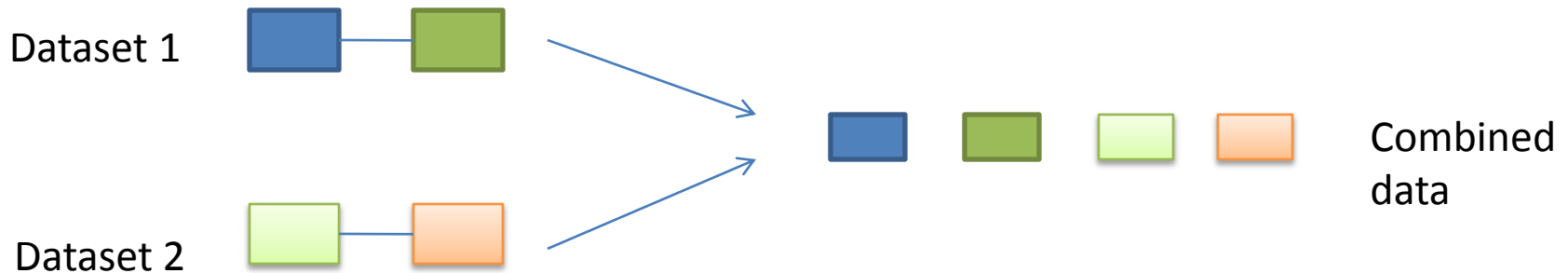
```
9  var articles = [{ "id": 1, "name": "vacuum cleaner", "brand_id": 2 },
10                      { "id": 2, "name": "washing machine", "brand_id": 1 }];
11
12  var brands = [{ "id": 1, "name": "SuperKitchen"
13                  }, { "id": 2, "name": "HomeSweetHome" }];
14
15  articles.forEach(function(article) {
16      var result = brands.filter(function(brand) {
17          return brand.id == article.brand_id;
18      });
19      delete article.brand_id;
20      article.brand = (result[0] != undefined) ? result[0].name : null;
21  });
22  //document.write(articles[0].brand);
23  for(i=0;i<articles.length;i++){
24      console.log(articles[i].brand,articles[i].name,articles[i].id,articles[i].brand_id);
25  }
```

HomeSweetHome vacuum cleaner 1 undefined

SuperKitchen washing machine 2 undefined

>

Add together rows from different data sets



- `_.zip`

```
_.zip(['moe', 'larry', 'curly'], [30, 40, 50], [true, false, false]);
```

```
=> [{"moe", 30, true}, {"larry", 40, false}, {"curly", 50, false}]
```

- `_.extend`

```
_.extend({name: 'moe'}, {age: 50});
```

```
=> {name: 'moe', age: 50}
```

Combine attributes from different data sets



- Two or more data sets that contain attributes describing the same observations, or conceptual entities, and they need to be combined.
- jQuery.js has extend method for this purpose.

(Continuing)

```
var object1 = {  
  red: 0,  
  blue: {lightblue:24, darkblue:12},  
  black:17  
};  
  
var object2= {  
  white: 200,  
  blue: {lightblue:40}  
};  
  
var object3= {  
  yellow:234,  
  white:150  
};  
  
var targetResult = $.extend({},object1,object2,object3);  
console.log(targetResult);
```

playing.ht

```
▼ Object {red: 0, blue: Object, black: 17, white: 150,  
yellow: 234} ⓘ  
  black: 17  
  ▼ blue: Object  
    lightblue: 40  
    ► __proto__: Object  
    red: 0  
    white: 150  
    yellow: 234  
    ► __proto__: Object
```

Summarizing data

- After data loading, we can find out the required data from the data set.
- Some of the important methods of **Math** object are
- `.min([value1[, value2[, ...]])`
`.max([value1[, value2[, ...]])`
`.pow(base, exponent)`
`.floor(x)`
`.ceil(x)`

Max & Min

```
var data = [  
    {"city": "ACity", "population": 652405},  
    {"city": "BCity", "population": 8405837},  
    {"city": "CCity", "population": 645966},  
    {"city": "DCity", "population": 467007}  
]; function finder(cmp, arr, attr) {  
    var val = arr[0][attr];  
    for(var i=1; i<arr.length; i++) {  
        val = cmp(val, arr[i][attr])  
    }  
    return val;  
} alert(finder(Math.max, data, "population"));  
alert(finder(Math.min, data, "population"));
```

Iterating Over and Reducing Data

- Most of the functions used to summarize data, need to iterate over the entire dataset to generate their results.

Main Methods	Functions	Syntax
forEach()	Executes a provided function once per array element.	<i>arr.forEach(callback[, thisArg])</i>
Map()	Creates a new array by calling a provided function on every element in this array.	<i>arr.map(callback[, thisArg]).</i>
Filtering	Select a subset of the data	<i>arr.filter(callback[, thisArg])</i>
Sorting	Specifies a function that defines the sort order	<i>arr.sort([compareFunction])</i>

forEach()

- Example:

```
var data = [{"city":"ACity", "population":652405,"land_area":83.9},  
            {"city":"BCity", "population":8405837, "land_area":302.6},  
            {"city":"CCity", "population":645966, "land_area":48.3},  
            {"city":"DCity", "population":467007, "land_area":315} ]; var count = 0;  
data.forEach(function(d) {  
  console.log(d.city);  
  count = count + 1;  
}); console.log(count);
```

⇒ ACity
BCity
CCity
Dcity
4

map()

```
14 var data = [  
15   {"city": "ACity", "population": 652405, "land_area": 83.9},  
16   {"city": "BCity", "population": 8405837, "land_area": 302.6},  
17   {"city": "CCity", "population": 645966, "land_area": 48.3},  
18   {"city": "DCity", "population": 467007, "land_area": 315}  
19 ];  
20
```

```
56 var smallData = data.map(function(d) {  
57  
58   return {  
59     name: d.city.toUpperCase(),  
60     population: d.population,  
61     rounded_area: Math.round(d.land_area)  
62   };  
63 });  
64 console.log(data[1]);  
65 console.log(smallData[1]);
```

iterating.html:64

Object {city: "BCity", population: 8405837, land_area: 302.6}

iterating.html:65

Object {name: "BCITY", population: 8405837, rounded_area: 303}

Filtering

- Select a subset of the data using the built in filter method.
- *Syntax: arr.filter(callback[, thisArg]).*
- Example:

```
var large_land = data.filter(function(d) { return d.land_area > 200; });  
console.log(large_land);
```

=>

```
[{"city": "BCity", "land_area": 302.6, "population": 8405837},  
{"city": "DCity", "land_area": 315, "population": 467007}]
```

Sorting

- Syntax: `arr.sort([compareFunction])`.
- Example:

```
data.sort(function(a,b) {  
    return b.population - a.population;  
});
```

```
console.log(data);
```

```
=> {"city":"BCity", "population":8405837, "land_area":302.6},  
{"city":"ACity", "population":652405, "land_area":83.9},  
{"city":"CCity", "population":645966, "land_area":48.3},  
{"city":"DCity", "population":467007, "land_area":315}
```

Reducing

- Applies a function against an accumulator and each value of the array to reduce it to a single value.
- Syntax : `arr.reduce(callback[, initialValue])`.
- Example:

```
var landSum = data.reduce(function(sum, d) {  
  return sum + d.land_area;  
}, 0);  
console.log(landSum);
```

=> 749.8.

Working with Strings

Basic methods	Function	Syntax
Stripping whitespaces	Remove whitespace from both sides of a string.	<code><string>.trim()</code>
<code>charAt(x)</code>	Access a character in a string using index x.	<code><string>.charAt(x)</code>
Find	Finding out a substring or extracting pieces out of a string	<code><string>.indexOf(<substring>);</code>
Replace	Replacing a character/substring within string.	<code><string>.replace(/<substring>/g, <new substring>);</code>

Regular Expressions

- Used to match certain patterns of strings within other strings.
- Useful tool for extracting *patterns* rather than exact strings.
- Two RegExp object methods (exec and test) and four String methods (match, search, replace and split) are used.
- Two types of syntax
 1. `var re = /ab+c/;`
 2. `var re = new RegExp("ab+c");`

Examples of regular expressions

- **Finding Strings**

```
var str = "how much wood would a woodchuck chuck if a woodchuck could  
chuck wood";  
var regex = /wood/;  
if (regex.test(str)) {  
  console.log("we found 'wood' in the string!");  
}
```

⇒ "we found 'wood' in the string!"

- **Replacing with regular expressions**

```
regex = /wood/g;  
var newstr = str.replace(regex, "nun");  
console.log(newstr);
```

⇒ "how much nun would a nunchuck chuck if a nunchuck could chuck nun"

Working with Time

- Data contain dates or times in an (mostly) arbitrary format and need to force that into an actual date.

```
var d = new Date ("2015-12");           // Tue Dec 01 2015 05:30:00
```

- We can also refer Date.js or moment.js libraries for methods to do this parsing.

```
E.g. Date.parse('9/16/2015') ;           // Wed Sep 16 2015 00:00:00 GMT+0530
```

```
moment("12-25-1995", "MM-DD-YYYY");
```

```
// Mon Dec 25 1995 00:00:00
```

- We can perform time modification.

Examples: `moment().format()`.

Checking Data Assumptions

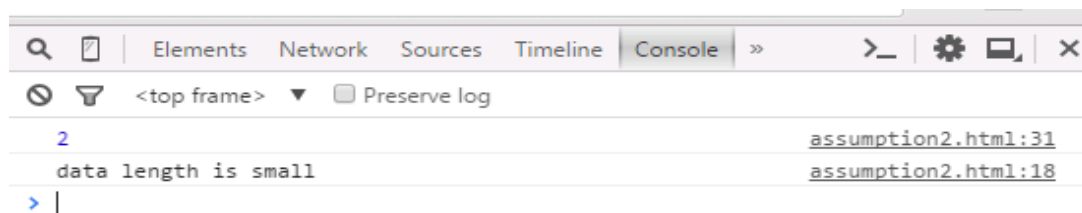
- Mistakes in data processing can be taken care by checking the assumptions about the shape and contents of data..
- Assertions :
- These tests can be created with assertions - functions that check the truthiness of a statement in code.

Example:

```
function assert(isTrue, message) {  
  if(!isTrue) {  
    console.log(message);  
    return false;  
  }  
  return true;  
}
```


Data Shape Assumptions: Using the assert () function to check some assumptions about the shape of data.

```
0
7  var data = [{"name":23,
8              "age":23,
9              "student":true},
10 [{"name":"Sleepwalker",
11     "age":NaN,
12     "student":false}
13 ];
14
15
16 function assert(isTrue, message) {
17   if(!isTrue) {
18     console.log(message);
19     return false;
20
21   } else{
22     return true;}
23 }
24
25 function checkDataShape(data) {
26   assert(data.length > 0, "data is empty");
27   assert(data.length > 4, "data length is small");
28 }
29 console.log(data.length);
30 checkDataShape(data);
```



Data Content Assumptions : Checking the content of the data is correct or not.

```
6
7  var data = [{"name":23,
8              "age":23,
9              "student":true},
10 [{"name":"Sleepwalker",
11     "age":NaN,
12     "student":false}
13 ];
14
15 function assert(isTrue, message) {
16   if(!isTrue) {
17     document.write(message);
18     return false;
19   } else{
20     return true;
21   }
22 }
23
24 function checkDataContent(d){
25   for(i=0;i<d.length;i++){
26
27     assert (typeof(d[i].name) == 'string',i+" no. element's name should be character, ");
28     assert (!isNaN(d[i].age), i+" no. element's age should be number, ");
29   }
30 }
31
32
33
34
35 checkDataContent(data);
36
```

0 no. element's name should be character, 1 no. element's age should be number,

Data Validation Approaches

- **Why?** To ensure that user input is clean, correct, and as expected.
- **Ways of validation:**
 - **Server side validation** → performed by a web **server**, after input has been submitted into the server.
 - **Client side validation** → performed by a web **browser**, before input is submitted into a web server. (will be discussed today).

Validation Techniques

- **JavaScript Validation API**
 - *Properties, Methods*
 - *Form Validation*
 - *Validation Using Regex*
- **External Frameworks**
 - *Parsley.js, Validate.js, Verify.js*

JavaScript Validation API

For every html control (*ex:Input*), the API provides set of **methods** and **properties** that can be performed and checked.

```
<input id="id1" type="number" min="100" max="300">
```

- **checkValidity():** Returns **true** if an input element contains valid data.
- **setCustomValidity():** Sets the **validationMessage** property of an input element.
- **Properties:** **validity**, **validationMessage**, **willValidate**
 - **validity:** rangeOverflow, rangeUnderflow, tooLong, typeMismatch..etc
 - **willValidate:** Indicates if an input element will be validated.

Example

```
<input id="id1" type="number" min="100" max="300">
```

```
var inpObj = document.getElementById("id1");  
  if (inpObj.checkValidity() == false)  
  {  
    alert( inpObj.validationMessage);  
  }
```

```
if(inpObj.validity.rangeOverflow)  
{ alert("Value too large"); }
```

JavaScript Form Validation

Validating HTML forms usually performed on submitting, example:

```
<form name="myForm" onsubmit="return validateForm()" method="post">  
  <input type="text" name="fname">
```

```
var x = document.forms["myForm"]["fieldname"].value;  
  if (x == null || x == "")  
{  
    alert("Name must be filled out");  
    return false;  
}
```

We can achieve the same with HTML5 tags, which let the browser understand and do the validation for you. No JS needed:

```
<input type="text" required>
```

Complex Constraints?

When developing complex constraints the DOM properties or a simple validation JS function is not enough / efficient.

For example if we want provide a validation logic for (Alphabets, numbers and space(' ') no special characters min 3 and max 20 characters) how would you do that?

Parse the value and test it against each of the rules? Complex logic / code? Efficient? Bug causing?

JavaScript Validation using Regular Expressions

To reduce the complexity of our validation logic and improve it's efficiency we can use **RegEx**.

Solution for: ***Alphabets, numbers and space(' ') no special characters min 3 and max 20 characters:***

```
var ck_name = /^[A-Za-z0-9 ]{3,20}$/;  
if (!ck_name.test({nameFieldValue}))  
{  
    alert("Invalid value");  
}
```

JavaScript Validation Frameworks

Motivation

- **Don't Reinvent The Wheel**
 - Why write code that's already been written (better)?
- **Do More With Less Code**
 - Pre-Defined utility functions

JS frameworks define multiple attributes / objects that get translated into special actions at runtime.

Parsley.js

Usage *(code snippets from our web-app):*

Form declaration:

Inline: `<form data-parsley-validate>`

JS Code: `$("#form[name=form-login"]).parsley();`

- `"data-parsley-pattern"` → Takes RegEx pattern
- `"data-parsley-required"` → Set the field as required
- `"data-parsley-trigger"` → Set trigger validation event
- `"data-parsley-error-message"` → Set custom error message

```
<input data-parsley-trigger="change"
data-parsley-required="true"
data-parsley-pattern="/^[A-Za-z0-9 ]{3,25}$/"
data-parsley-error-message="Your name is required and cannot have danger
characters with length between 3 - 25">
```

Parsley.js

Usage *(code snippets from our web-app):*

Confirm Password:

```
<input type="password" data-parsley-equalto="#password1">
```

Custom Validation Rule:

```
<input data-parsley-userexist >
```

```
window.ParsleyValidator.addValidator('userexist', function({Value},  
[requirements]) {  
    if(expression){  
        return false;  
    }  
    return true;  
}).addMessage('en', 'userexist', 'This username is in-use, choose different  
one');
```

Verify.js

Usage (some of what can be done):

- Field validation as number, email, url or required (one or multiple):

`data-validate="{number,required}"`

- Using RegEx: `data-validate="regex(abc, Must contain abc)"`

- Custom Validation/function: `data-validate="customValidationFcn"`

Some other properties:

`hideErrorOnChange` → Hide error while the user is editing the field

`beforeSubmit` → Pre-form-submit hook/function. If returns true, form will submit

Validate.js:

- Introduces new object “FormValidator”
- Definition: `var validator = new FormValidator ({formName}, fields, callback)`
- Callback: A function that will fire after all validation rules are success.
- Fields: Array of the form fields that's being constructed as
 - “name” - required →html field name,
 - “rules” – required →either a predefined or custom rule,
 - “depends” - optional →a function that runs before the field is validated, if it returns “false” the field will not be validated.

I don't like:

Parsley.js: The documentation is not clear for the advanced usage.
I think it can be done better than this.

Verify.js: Not a good option for big complicated applications in terms of features (*ex: no pre-defined validate on “change” event*).

Validate.js: Usability and readability are not good (*ex: no inline DOM rules definition*), only basic pre-defined functionality.

I like:

Parsley.js: Big community, powerful ready features (just add a DOM attribute), code readability is very good.

Verify.js: Simple, ease-of-use, good readability and clear documentation. Would definitely use for simple application.

Validate.js: No dependencies (not even JQuery), JS util code written for you.

Some Facts & My Opinion

JavaScript Validation	JavaScript API	Parsley.js	Verify.js	Validate.js
	★	★★★★	★★★	★★
Rely on JQuery?	NO	YES	YES	NO
Useability	Fair	Very Good	Very Good	Good
Productivity	Fair	Very Good	Good	Good
Size	None	6.6 KB	25 KB	7 KB
Community	Excelent	Excelent	Good	Good
Documentation	Excelent	Very Good	Very Good	Very Good

Thank you for your attention

Questions?

References

Janko Jovanovic, Web Form Validation: Best Practices and Tutorials,
<http://www.smashingmagazine.com/2009/07/web-form-validation-best-practices-and-tutorials/>

parsley.js, <http://parsleyjs.org/>

validate.js, <http://rickharrison.github.io/validate.js/>

verify.js, <http://verifyjs.com/>

<https://developer.mozilla.org/en-US/docs/Web/JavaScript>

<http://www.html5rocks.com/en/tutorials/file/dndfiles/>

<http://www.slideshare.net/quentinadam/javascript-as-data-processing-language-html5-integration>

<https://lodash.com/docs>

<https://www.dashingd3js.com/table-of-contents>