Google Cloud Platform Machine Learning Service
- Prediction API를 중심으로 -

김진형
2017.03.28.

Google Prediction API (1/2)

1. **Google**
https://www.google.com/

2. Google **product**
https://www.google.com/intl/en/about/products/

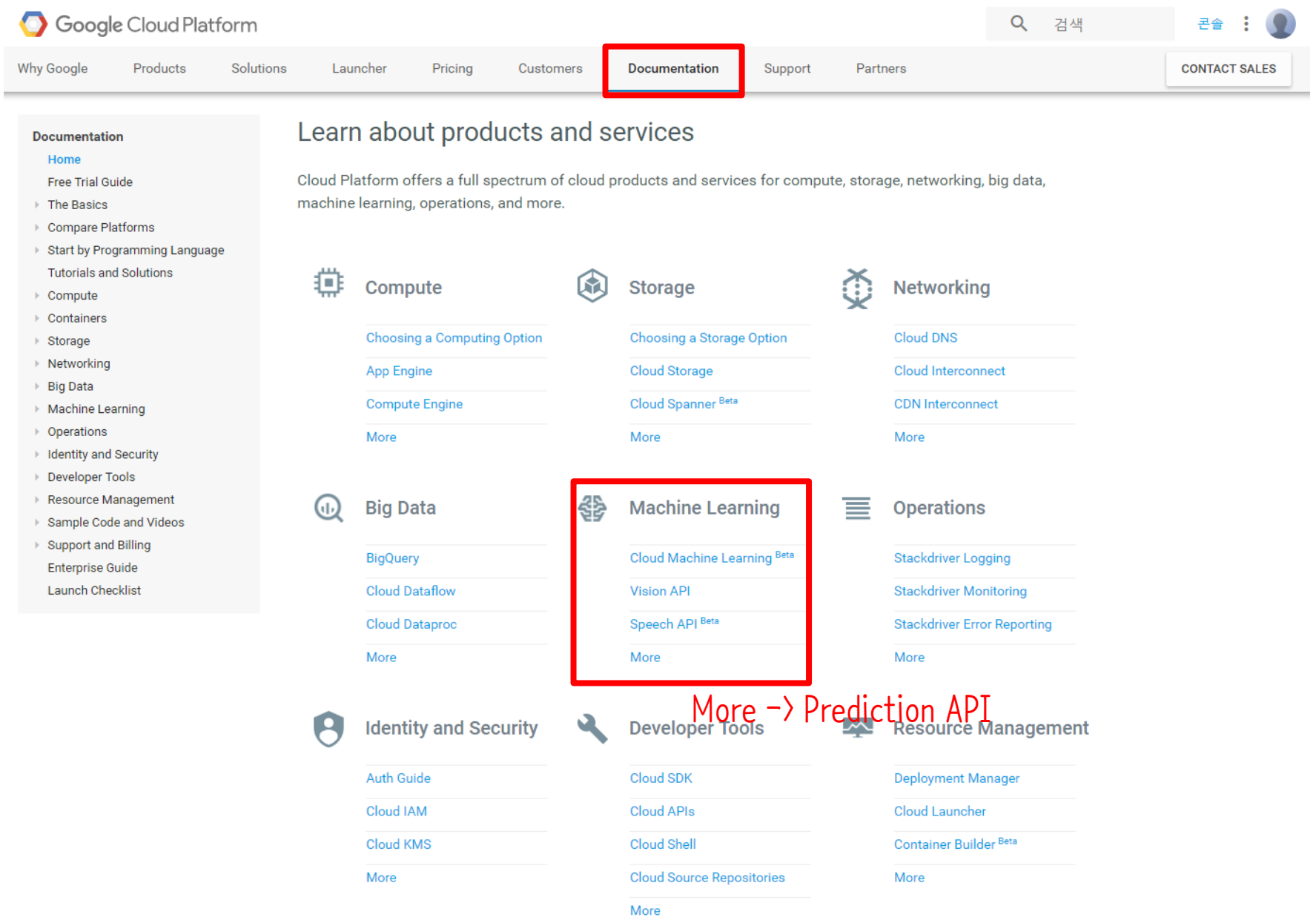
3. Google product **for Developers**
https://developers.google.com/products/?hl=kr

4. Google product for Developers -> **Google Cloud Platform**
https://cloud.google.com/

5. Google product for Developers -> Google Cloud Platform -> **Machine Learning**
https://cloud.google.com/docs/

6. Google product for Developers -> Google Cloud Platform -> Machine Learning -> **Prediction API**
https://cloud.google.com/prediction/docs/

Google Prediction API (2/2)



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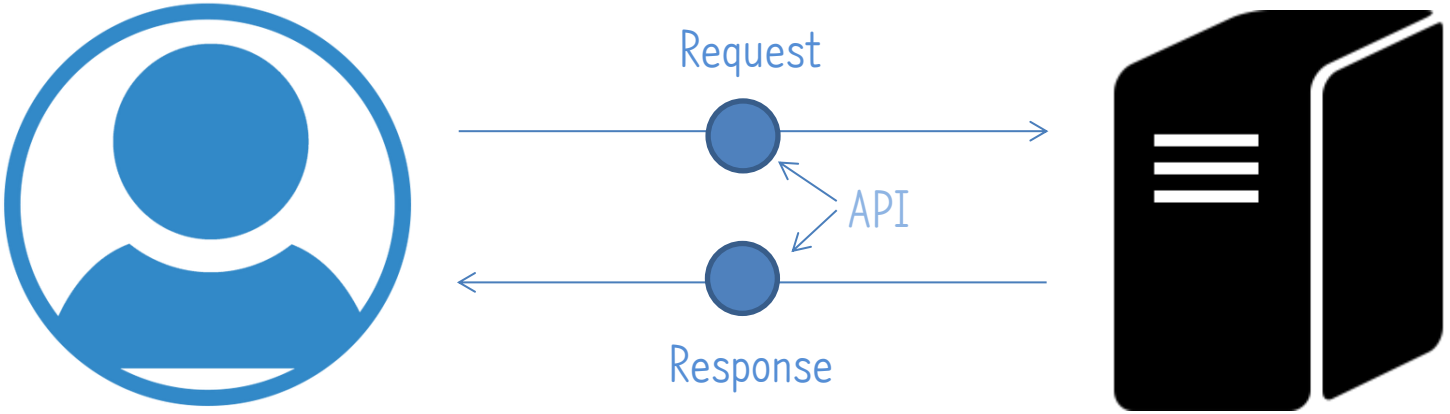
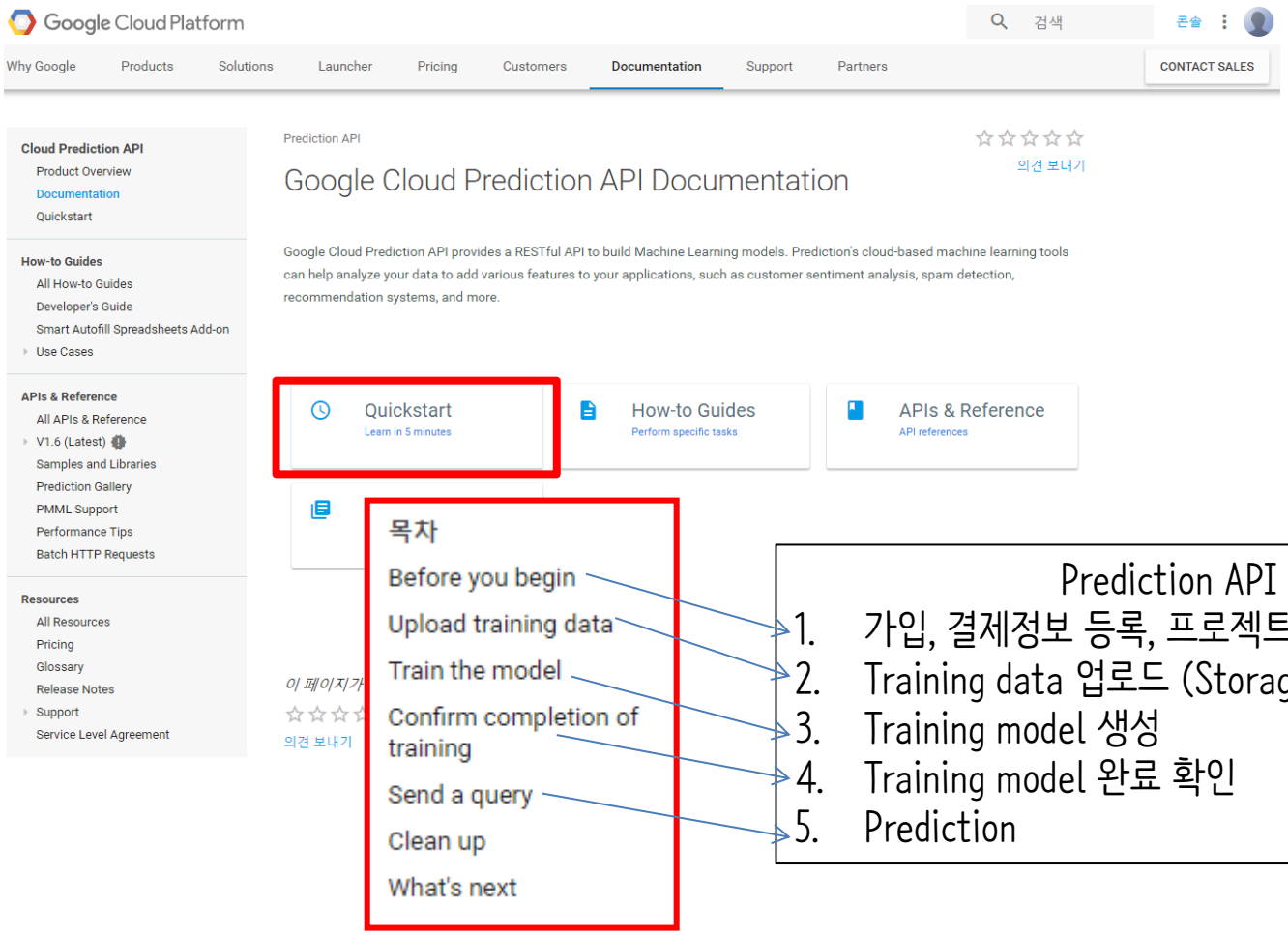
- Prediction API로 이해하기

API를 어떻게 이해할 것인가? - 간단한 설명 (1/1)

Application Programming Interface(API)



API를 어떻게 이해할 것인가? – Prediction API를 기반으로 (1/1)



Prediction API 사용법

1. 가입, 결제정보 등록, 프로젝트 생성, Enable API
2. Training data 업로드 (Storage API)
3. Training model 생성
4. Training model 완료 확인
5. Prediction

API를 어떻게 이해할 것인가? – Prediction API 사용법 1 (1/5)

Quickstart

Learn in 5 minutes

목차

Before you begin

1. Select or create a Cloud Platform project.

   GO TO THE PROJECTS PAGE

2. Enable billing for your project.

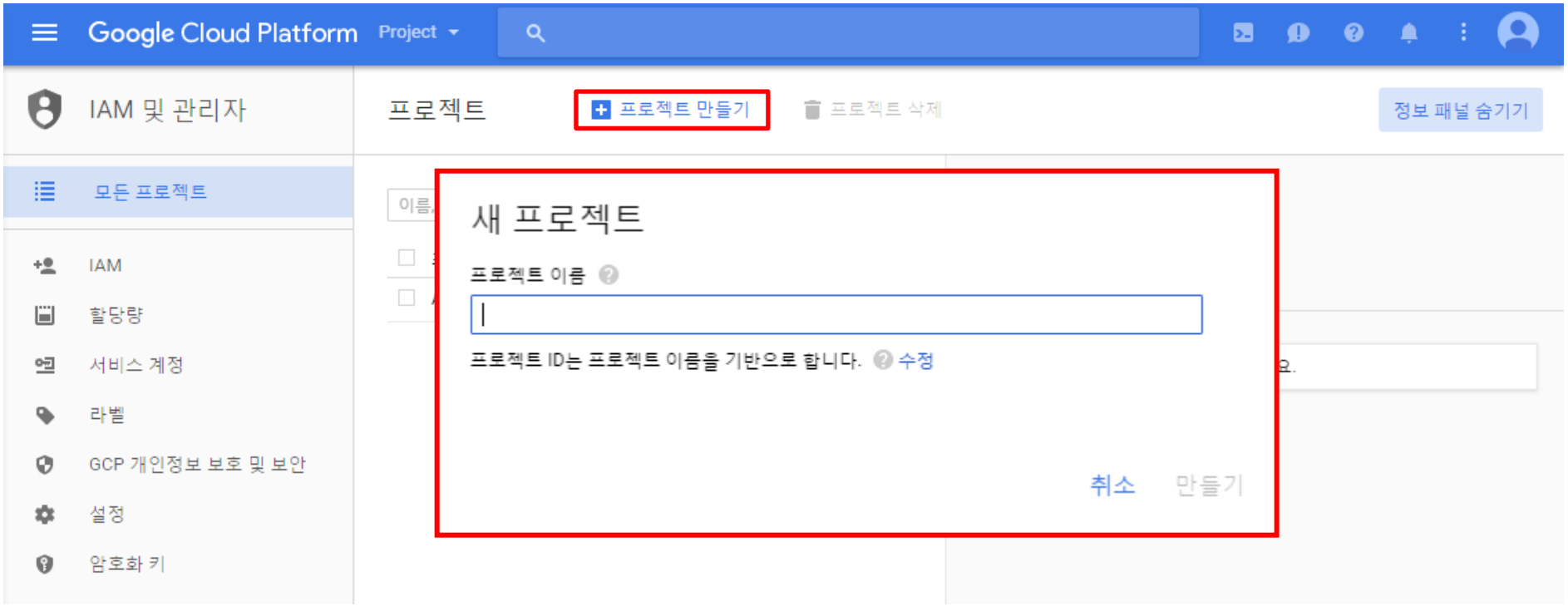
   ENABLE BILLING

3. Enable the Prediction and Google Cloud Storage APIs for your project. Because you will use the APIs Explorer for this quickstart, you don't need to go to the Credentials page afterward.

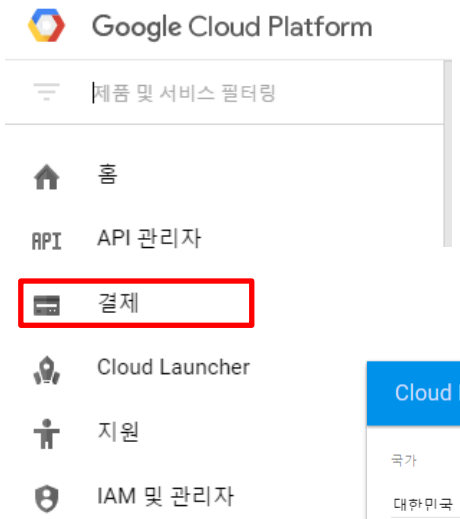
4. Download the sample training data file (`language_id.txt`). This file contains several text snippets and the language of each snippet (English, Spanish, or French) as CSV data.

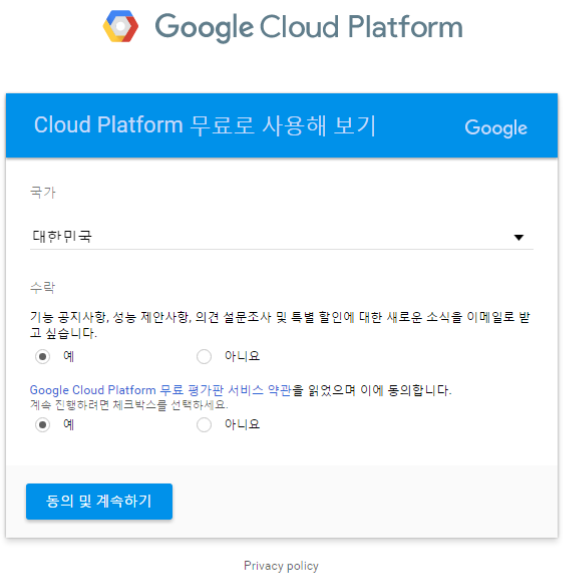
API를 어떻게 이해할 것인가? – Prediction API 사용법 1 (2/5)

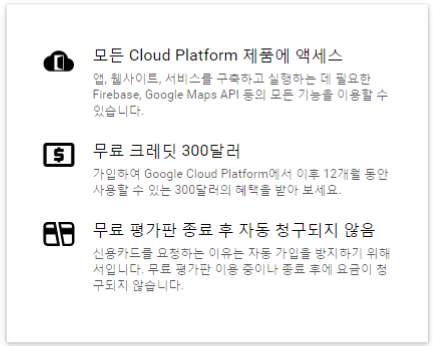
https://console.cloud.google.com/



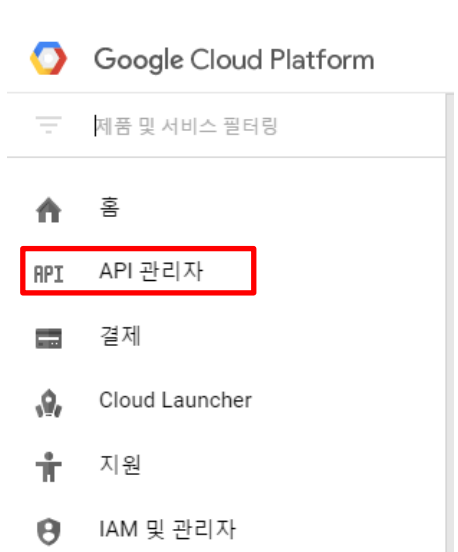
API를 어떻게 이해할 것인가? – Prediction API 사용법 1 (3/5)

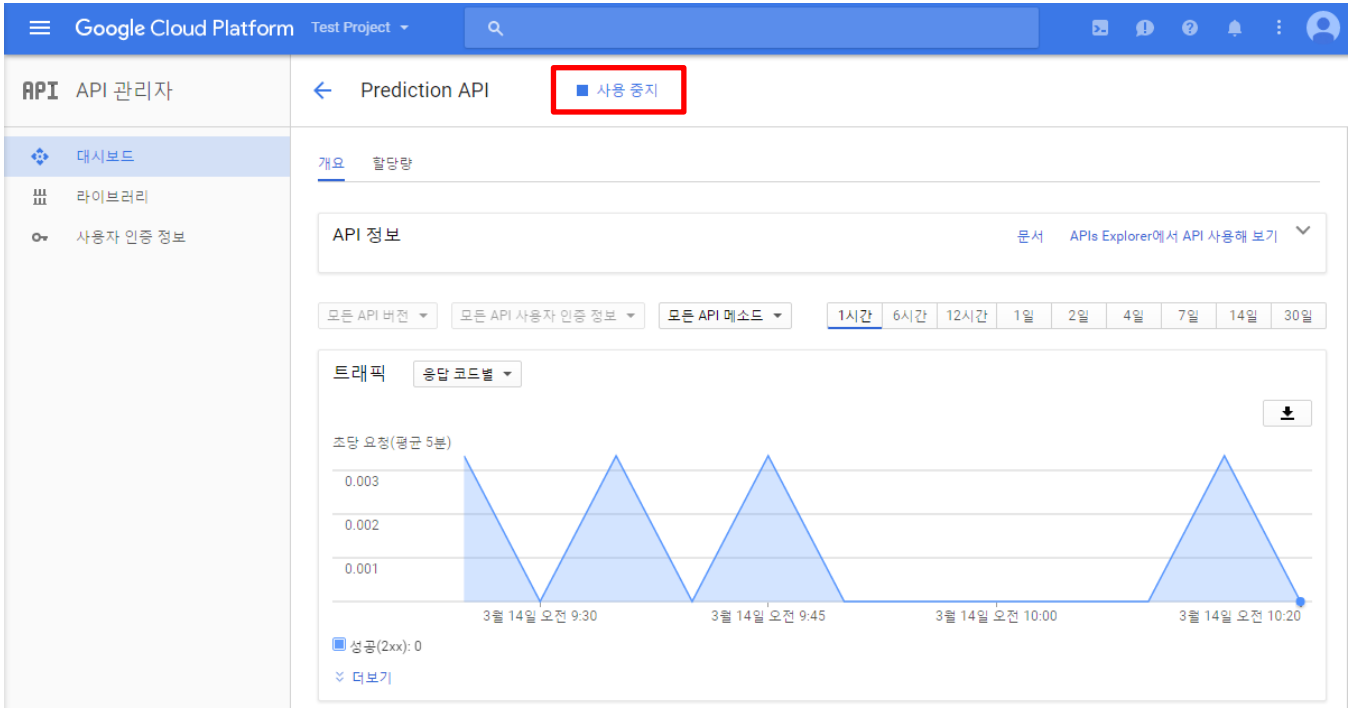


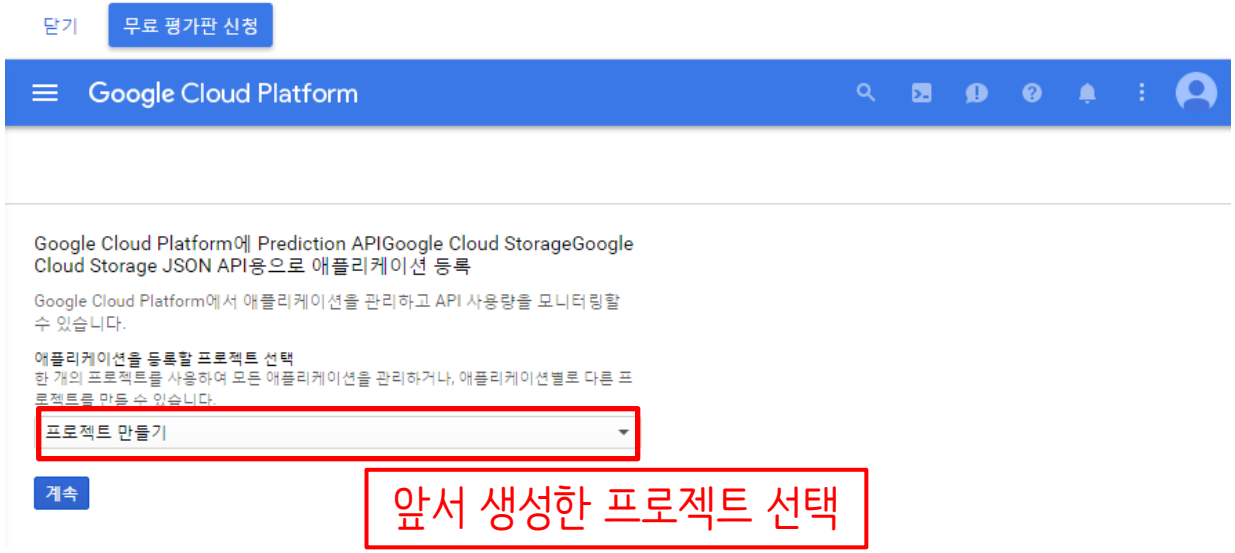




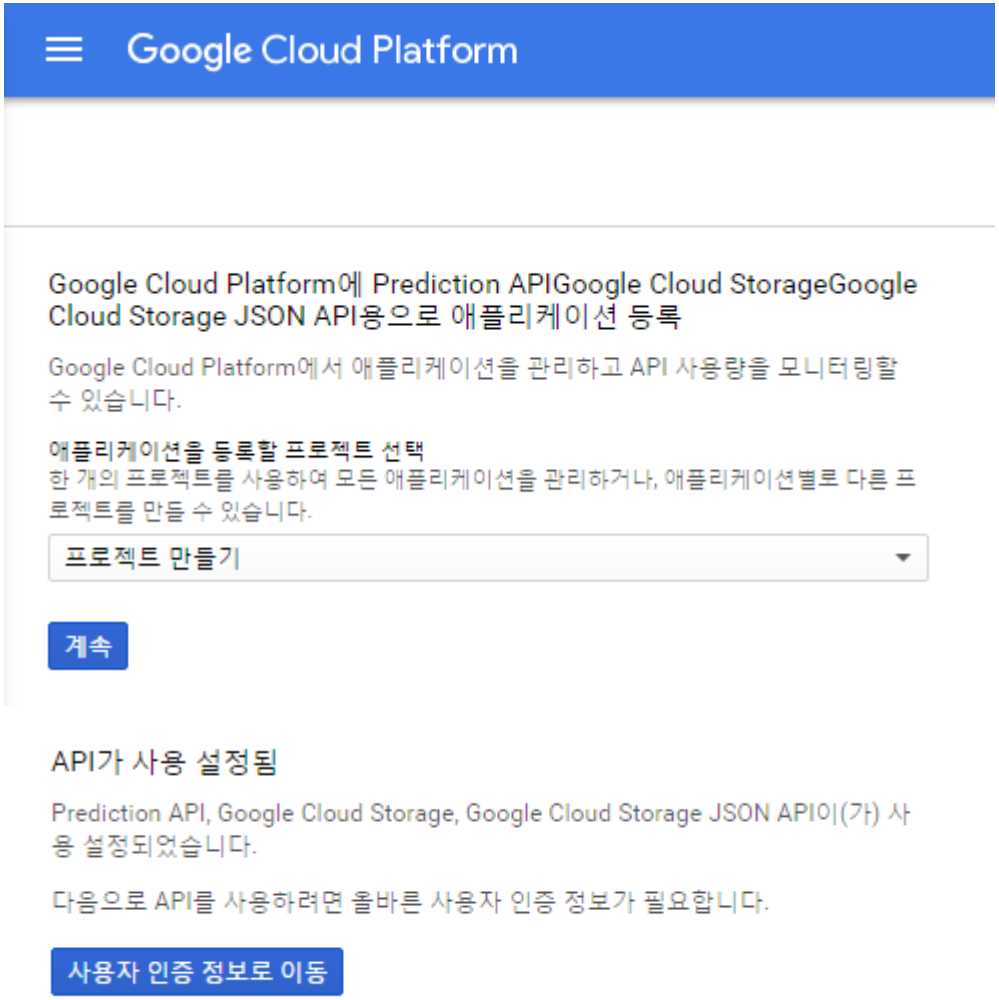
API를 어떻게 이해할 것인가? – Prediction API 사용법 1 (4/5)







API를 어떻게 이해할 것인가? – Prediction API 사용법 1 (5/5)

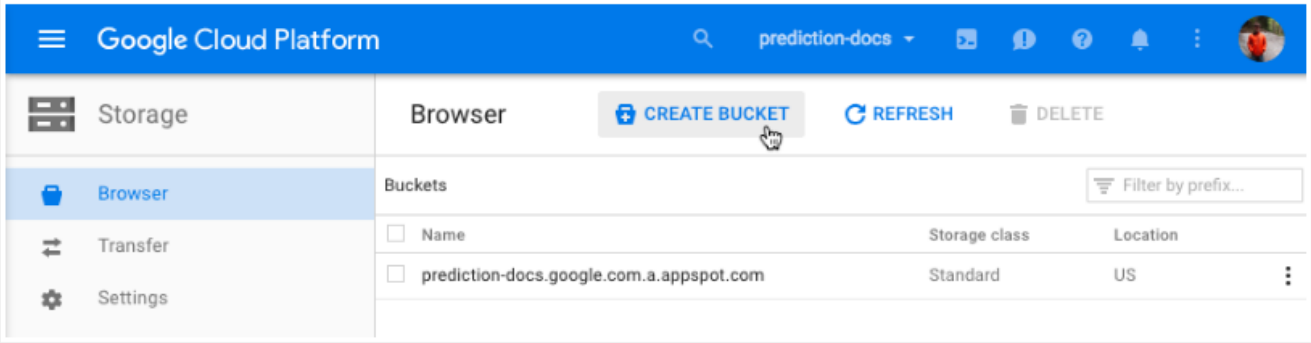


뒤에서 좀 더 자세히..

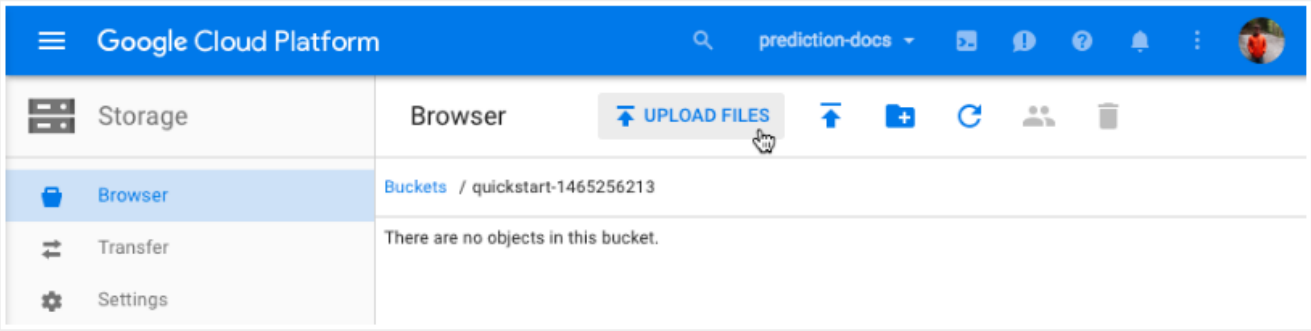
API를 어떻게 이해할 것인가? – Prediction API 사용법 2 (1/1)

Upload training data

1. In the Google Cloud Platform Console:
   OPEN THE CLOUD STORAGE BROWSER
2. Click **Create bucket** to create a new bucket.



3. Enter a globally unique name in the **Name** field. The following name has been generated for you if you'd like to use it: `quickstart-1488954768` . Or, pick your own.
4. Keeping the default values for the other fields, click **Create**.
5. After the bucket is created, click **Upload Files** and upload `language_id.txt` .



Quickstart
Learn in 5 minutes

목차

API를 어떻게 이해할 것인가? – Prediction API 사용법 3 (1/2)

Train the model

To train the model, call the `prediction.trainedmodels.insert` method, passing a unique name for this predictive model, and the location of the training data.

```
POST https://www.googleapis.com/prediction/v1.6/projects/[PROJECT_ID]/trainedmodels
{
 "id": "language-identifier",
 "storageDataLocation": "quickstart-1465256213/language_id.txt"
}
```

Use the button below to send this request using the APIs Explorer. You must replace the following values in the Explorer:

- **project**: Your Cloud Platform Console project ID.
- **Request body**: Update the value of `storageDataLocation` with your bucket name.

TRY IT!

A successful response looks like:

Click

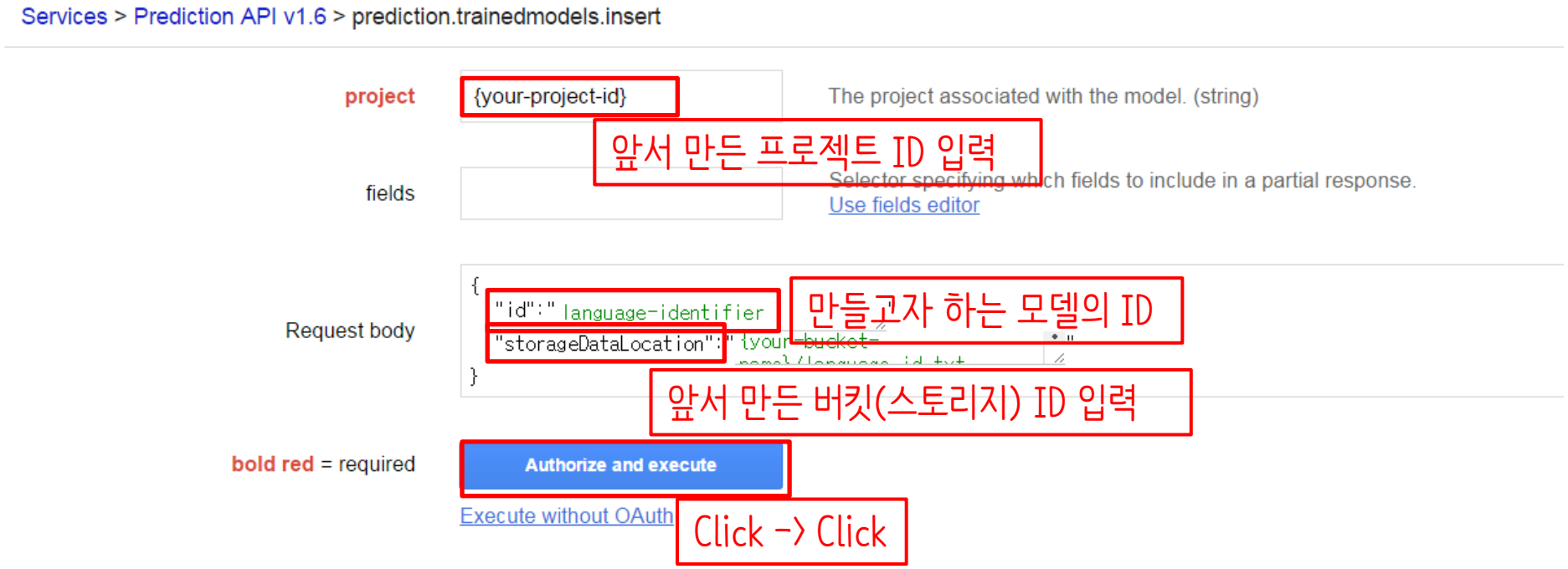
```
{
 "kind": "prediction#training",
 "id": "language-identifier",
 "selfLink": "https://www.googleapis.com/prediction/v1.6/projects/prediction-docs/trainedmodels/langu
 "storageDataLocation": "quickstart-1465256213/language_id.txt"
}
```

Quickstart

Learn in 5 minutes

목차

API를 어떻게 이해할 것인가? - Prediction API 사용법 3 (2/2)



API를 어떻게 이해할 것인가? – Prediction API 사용법 4 (1/2)

Confirm completion of training

Use the `prediction.trainedmodels.get` method to check the status of training, passing the ID of the predictive model.

```
GET https://www.googleapis.com/prediction/v1.6/projects/[PROJECT_ID]/trainedmodels/language-identifie
```

Use the button below to send this request using the APIs Explorer. You must replace the following values in the Explorer:

- **project**: Your Cloud Platform Console project ID.

TRY IT!

Click

In the response, examine the `trainingStatus` property to see if the status is `RUNNING` or `DONE`:

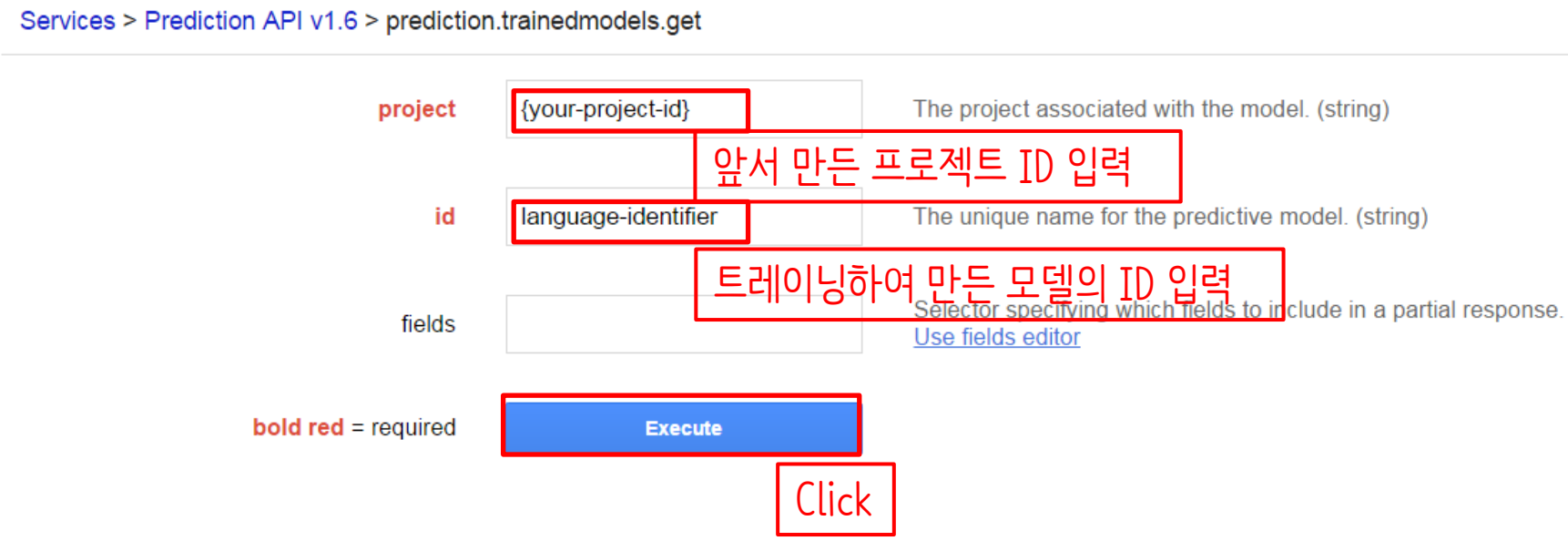
```
{
 "kind": "prediction#training",
 "id": "language-identifier",
 "selfLink": "https://www.googleapis.com/prediction/v1.6/projects/prediction-docs/trainedmodels/langu
 "created": "2016-06-07T22:51:13.702Z",
 "trainingComplete": "2016-06-07T22:51:32.468Z",
 "modelInfo": {
  "numberInstances": "406",
  "modelType": "classification",
  "numberLabels": "3",
  "classificationAccuracy": "0.99"
 },
 "trainingStatus": "DONE"
}
```

Quickstart

Learn in 5 minutes

목차

API를 어떻게 이해할 것인가? – Prediction API 사용법 4 (2/2)



API를 어떻게 이해할 것인가? – Prediction API 사용법 5 (1/2)

Send a query

After the training is complete, you can send queries to the service to be evaluated against the predictive model. To do so, call the `prediction.trainedmodels.predict` method, passing the name of the model and the query.

```
POST https://www.googleapis.com/prediction/v1.6/projects/prediction-docs/trainedmodels/language-ident

{
 "input": {
  "csvInstance": [
   "Sont des mots qui vont tres bien ensemble"
  ]
 }
}
```

Use the button below to send this request using the APIs Explorer. You must replace the following values in the Explorer:

- **project**: Your Cloud Platform Console project ID.

TRY IT!

In the response, examine the `outputLabel` property to see what language the Google Prediction API thinks the string is in:

Click

```
{
 "kind": "prediction#output",
 "id": "language-identifier",
 "selfLink": "https://www.googleapis.com/prediction/v1.6/projects/prediction-docs/trainedmodels/langu
 "outputLabel": "French",
 "outputMulti": [
  {
   "label": "English",
   "score": "0.000000"
  },
  {
   "label": "French",
   "score": "1.000000"
  },
  {
   "label": "Spanish",
   "score": "0.000000"
  }
 ]
}
```

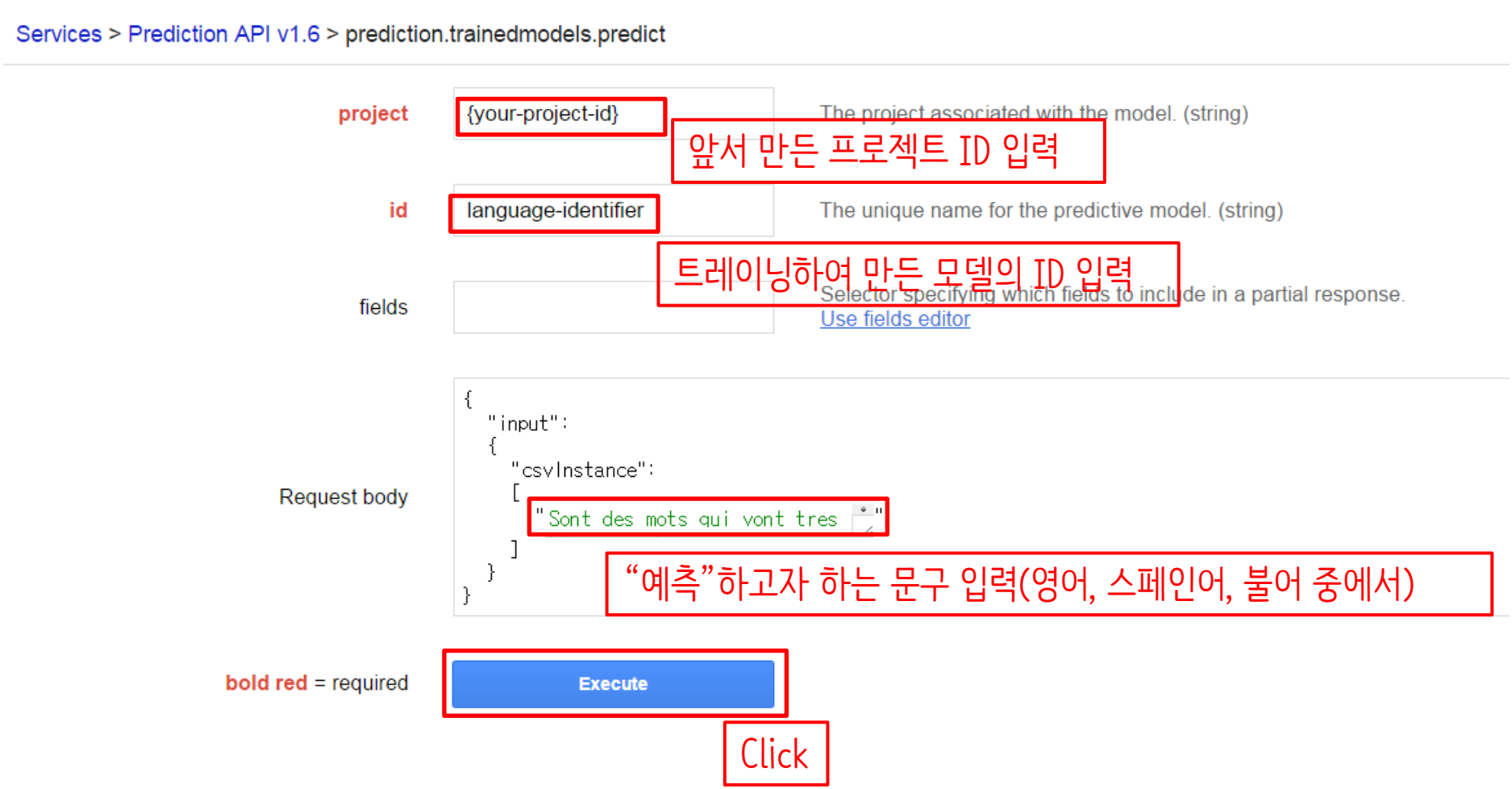
You can try sending queries in either of the other languages that the model was trained on (English and Spanish).

Quickstart

Learn in 5 minutes

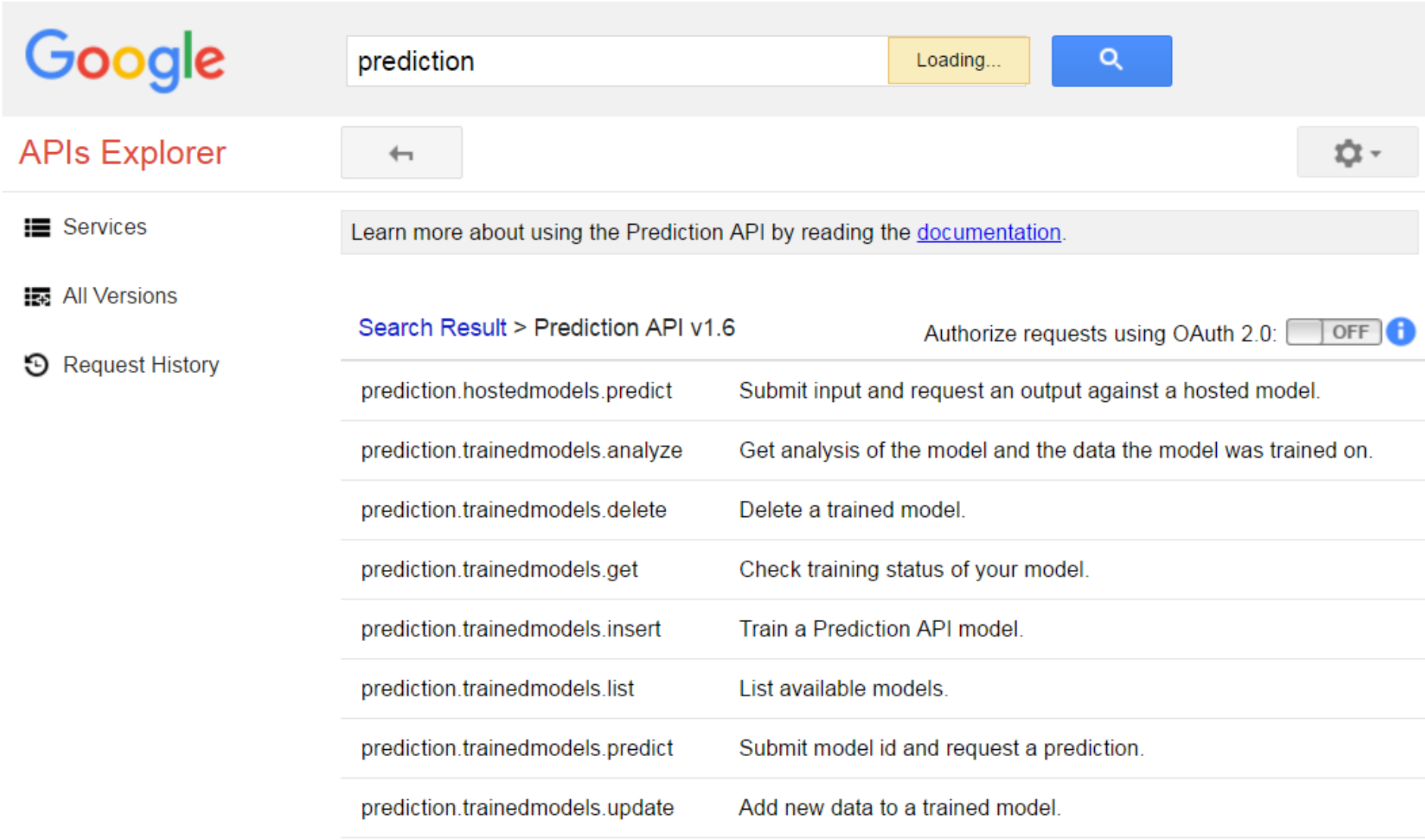
목차

API를 어떻게 이해할 것인가? – Prediction API 사용법 5 (2/2)



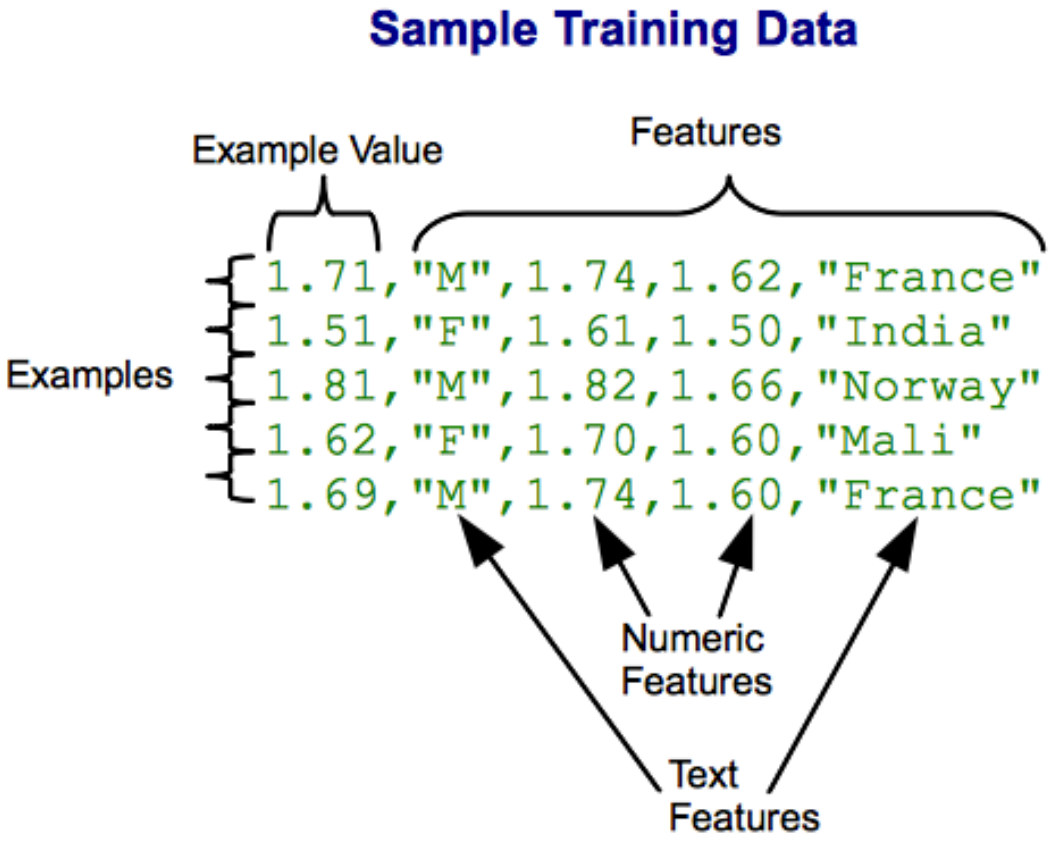
API를 어떻게 이해할 것인가? – Prediction API로 이해하기 (1/1)

https://developers.google.com/apis-explorer/



API를 어떻게 활용할 것인가?
- Structuring Data
- Upload Data
- Authentication
- Node.js를 활용한 코드

API를 어떻게 활용할 것인가? - Structuring Data (1/4)



API를 어떻게 활용할 것인가? - Structuring Data (2/4)

Training Data File Format

Training data file is uploaded to Google Cloud Storage as a CSV (comma-separated value) file. Think of this file as a table, with each row representing one example, and commas separating columns. The first column is the example value, and all additional columns are features.

Empty cells will not cause an error, but you should avoid having empty cells because an empty string cell evaluates to "" (text features) or zero (numeric features), which will throw off the matching algorithm. There is no way to differentiate "unknown value" from zero or "" in the data.

After training a model from a data file, you can add additional training data to a model data using streaming training. You can also delete model.

The CSV training file must follow these conventions:

- Maximum file size is 2.5GB
- You must have a minimum of six examples in your training file
- No header row is allowed
- Only one example is allowed per line. A single example cannot contain newlines, and cannot span multiple lines.
- Columns are separated by commas. Commas inside a quoted string are not column delimiters.
- The first column represents the value (numeric or string) for that example. If the first column is numeric, this model is a regression model; if the first column is a string, it is a categorization model. Each column must describe the same kind of information for that example.
- The column order of features in the table does not weight the results; the first feature is not weighted any more than the last.
- As a best practice, remove punctuation (other than apostrophes ') from your data. This is because commas, periods, and other punctuation rarely add meaning to the training data, but are treated as meaningful elements by the learning engine. For example, "end." is not matched to "end".

API를 어떻게 활용할 것인가? - Structuring Data (3/4)

- **Text strings**:
  - Place double quotes around all text strings.
  - Text matching is case-sensitive: "wine" is different from "Wine."
  - If a string contains a double quote, the double quote must be escaped with another double quote, for example: "sentence with a ""double"" quote inside"
  - Strings are split at whitespace into component words as part of the prediction matching. That is, "Godzilla vs Mothra" will be split into "Godzilla", "vs", and "Mothra" when searching for closest matches. If you require a string to remain unsplit, such as for proper names or titles, use underscores or some other character instead of whitespace between words. For example: Godzilla_vs_Mothra. If you want to assign a set of labels to a single feature, simply include the labels: for example, a genre feature of a movie entry might be "comedy animation black_and_white". The order of words in a string also does not affect matching value, only the quantity of matched words.
  - Quoting a substring does not guarantee an exact match. That is, placing quotes around the phrase "John Henry" will not force matches only with "John Henry"; "John Henry" has partial matches to both "John" and "Henry". However, more matches per string generates a higher score, so "John Henry" will match "John Henry" best.
- **Numeric values**:
  - Both integer and decimal values are supported.
  - Numbers in quotes without whitespace will be treated as numbers, even if they are in quotation marks. Multiple numeric values within quotation marks in the same field will be treated as a string. For example:
    - Numbers: "2", "12", "236"
    - Strings: "2 12", "a 23"

API를 어떻게 활용할 것인가? – Structuring Data (4/4)

For categorization model

	A	B	C	D	E
1	F	0.378487	-0.01278	0.359555	-1.79957
2	F	-0.85324	-1.51883	0.045366	0.001923
3	T	0.747537	0.868592	-0.66966	-1.70514
4	T	0.933162	0.079565	-1.18398	0.8003
5	F	-0.93291	-0.37751	1.678622	-2.11681
6	T	0.139463	0.496548	-0.2819	-0.09795
7	F	-0.10949	-0.54634	0.543921	-0.18542
8	T	0.045765	0.562324	-0.30935	0.777913
9	F	0.055782	-0.7851	0.209391	-0.1538
10	T	1.16569	0.690024	0.271404	0.216281
11	T	-0.25918	-0.07874	-0.2608	0.516445
12	T	0.744942	1.346154	-0.19878	0.76774

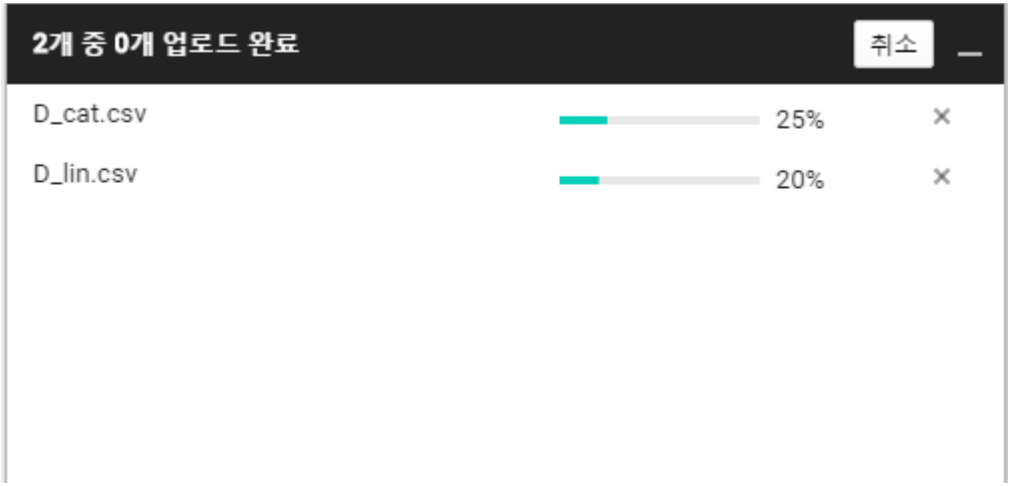
For regression model

	A	B	C	D	E
1	-2.04246	0.378487	-0.01278	0.359555	-1.79957
2	-2.06037	-0.85324	-1.51883	0.045366	0.001923
3	0.145093	0.747537	0.868592	-0.66966	-1.70514
4	5.920947	0.933162	0.079565	-1.18398	0.8003
5	-7.5433	-0.93291	-0.37751	1.678622	-2.11681
6	3.50033	0.139463	0.496548	-0.2819	-0.09795
7	-1.09369	-0.10949	-0.54634	0.543921	-0.18542
8	5.35553	0.045765	0.562324	-0.30935	0.777913
9	-0.26916	0.055782	-0.7851	0.209391	-0.1538
10	4.293475	1.16569	0.690024	0.271404	0.216281
11	3.984568	-0.25918	-0.07874	-0.2608	0.516445
12	8.857899	0.744942	1.346154	-0.19878	0.76774

API를 어떻게 활용할 것인가? - Upload Data (1/1)

버킷 / quickstart-1488936542

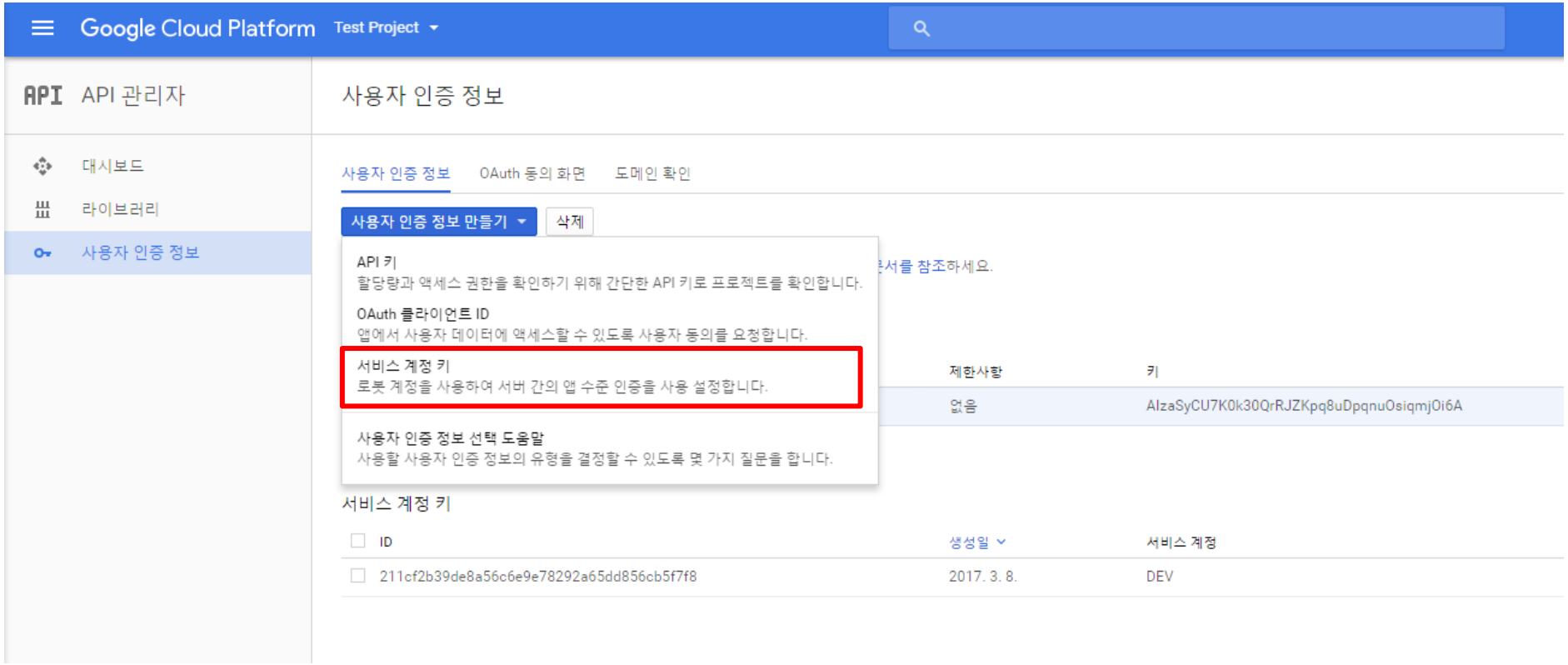
이름	크기	유형	저장소 클래스	최종 수정 시간
D_cat.csv	50.12MB	application/vnd.ms-excel	Multi-Regional	17. 3. 13. 오후 1:41
D_lin.csv	59.84MB	application/vnd.ms-excel	Multi-Regional	17. 3. 13. 오후 1:41
language_id.txt	145.07KB	text/plain	Multi-Regional	17. 3. 8. 오전 10:54



API를 어떻게 활용할 것인가? - Authentication (1/4)

https://cloud.google.com/vision/docs/common/auth
https://cloud.google.com/vision/docs/common/auth#set_up_a_service_account

Set up a service account



API를 어떻게 활용할 것인가? - Authentication (2/4)

=> 복잡한 이름의 JSON 파일이 다운로드 됨

API를 어떻게 활용할 것인가? - Authentication (3/4)

https://developers.google.com/identity/protocols/application-default-credentials

Authenticating with Application Default Credentials

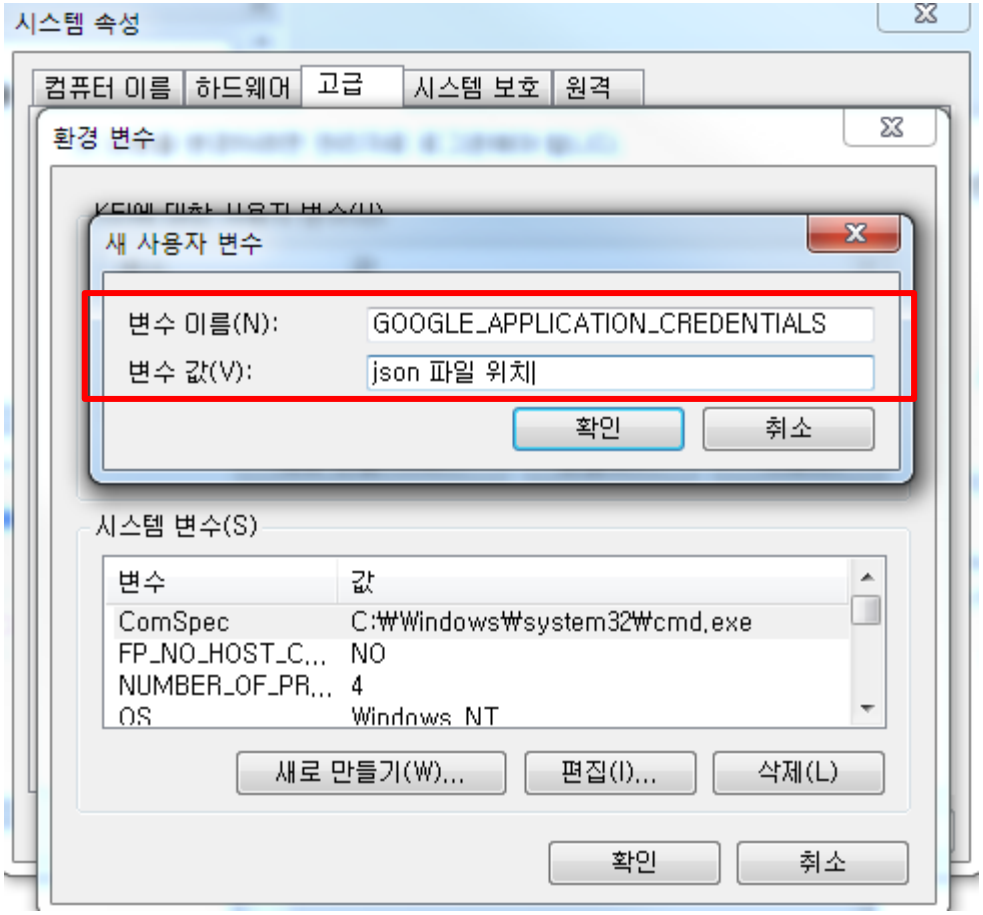
How the Application Default Credentials work

You can get Application Default Credentials by making a single client library call. The credentials returned are determined by the environment the code is running in. Conditions are checked in the following order:

1. The environment variable `GOOGLE_APPLICATION_CREDENTIALS` is checked. If this variable is specified it should point to a file that defines the credentials. The simplest way to get a credential for this purpose is to create a Service account key in the Google API Console:
    a. Go to the API Console Credentials page.
    b. From the project drop-down, select your project.
    c. On the Credentials page, select the **Create credentials** drop-down, then select **Service account key**.
    d. From the **Service account** drop-down, select an existing service account or create a new one.
    e. For **Key type**, select the **JSON** key option, then select **Create**. The file automatically downloads to your computer.
    f. Put the *.json file you just downloaded in a directory of your choosing. This directory must be private (you can't let anyone get access to this), but accessible to your web server code.
    g. Set the environment variable `GOOGLE_APPLICATION_CREDENTIALS` to the path of the JSON file downloaded.
2. If you have installed the Google Cloud SDK on your machine and have run the command `gcloud auth application-default login`, your identity can be used as a proxy to test code calling APIs from that machine.
3. If you are running in Google App Engine production, the built-in service account associated with the application will be used.
4. If you are running in Google Compute Engine production, the built-in service account associated with the virtual machine instance will be used.
5. If none of these conditions is true, an error will occur.

앞서 다운로드 받은 *.json 파일을 원하는 위치에 두고
GOOGLE_APPLICATION_CREDENTIALS라는 이름의 환경변수를 생성

API를 어떻게 활용할 것인가? - Authentication (4/4)



API를 어떻게 활용할 것인가? - Node.js를 활용한 코드 (1/5)

https://github.com/keibigdata/GCPStudy

```
29 function train (callback) {
30   auth(function (err, authClient) {
31
32     if (err) {
33       return callback(err);
34     }
35
36     var trainedmodels = google.prediction({
37       version: 'v1.6',
38       auth: authClient
39     }).trainedmodels;
40
41     trainedmodels.insert({
42       project: 'test-project-160901',
43       resource: {
44         "id": "random-regression",
45         "storageDataLocation": "quickstart-1488936542/D_lin.csv"
46       }
47     }, function (err, res){
48       if(err) console.log(err);
49       console.log(res);
50     });
51
52   });
53 }
```

```
D:₩01 Study₩07 GCP>node training.js
{ kind: 'prediction#training',
  id: 'random-regression',
  selfLink: 'https://www.googleapis.com/prediction/v1.6/projects/test-project-16
0901/trainedmodels/random-regression',
  storageDataLocation: 'quickstart-1488936542/D_lin.csv' }
```

API를 어떻게 활용할 것인가? – Node.js를 활용한 코드 (2/5)

```
28  function get (callback) {
29    auth(function (err, authClient) {
30
31      if (err) {
32        return callback(err);
33      }
34
35      var trainedmodels = google.prediction({
36        version: 'v1.6',
37        auth: authClient
38      }).trainedmodels;
39
40      trainedmodels.get({
41        project: 'test-project-160901',
42        id: "random-regression"
43      }, function (err, res){
44        if(err) console.log(err);
45        console.log(res);
46      });
47
48    });
49  }
```

```
D:₩01 Study₩07 GCP>node get.js
{ kind: 'prediction#training',
  id: 'random-categorization',
  selfLink: 'https://www.googleapis.com/prediction/v
0901/trainedmodels/random-categorization',
  created: '2017-03-14T23:51:54.731Z',
  trainingComplete: '2017-03-14T23:53:11.351Z',
  modelInfo:
   { numberInstances: '700000',
     modelType: 'classification',
     numberLabels: '3',
     classificationAccuracy: '0.94' },
  trainingStatus: 'DONE' }
```

```
D:₩01 Study₩07 GCP>node get.js
{ kind: 'prediction#training',
  id: 'random-regression',
  selfLink: 'https://www.googleapis.com/prediction/v1.6/projects/test-project-16
0901/trainedmodels/random-regression',
  created: '2017-03-13T05:46:51.717Z',
  trainingStatus: 'RUNNING' }
```

```
D:₩01 Study₩07 GCP>node get.js
{ kind: 'prediction#training',
  id: 'random-regression',
  selfLink: 'https://www.googleapis.com/prediction/v1.6/projects/test-project-16
0901/trainedmodels/random-regression',
  created: '2017-03-13T05:46:51.717Z',
  trainingComplete: '2017-03-13T07:44:29.128Z',
  modelInfo:
   { numberInstances: '1000000',
     modelType: 'regression',
     meanSquaredError: '1.01' },
  trainingStatus: 'DONE' }
```

API를 어떻게 활용할 것인가? - Node.js를 활용한 코드 (3/5)

```
28  function predict (callback) {
29    auth(function (err, authClient) {
30
31      if (err) {
32        return callback(err);
33      }
34
35      var trainedmodels = google.prediction({
36        version: 'v1.6',
37        auth: authClient
38      }).trainedmodels;
39
40      trainedmodels.predict({
41        project: 'test-project-160901',
42        id: "random-regression",
43        resource: {
44          input: {
45            csvInstance: [-2.1, 3.1, 4.1, 3.1]
46          }
47        }
48      }, function (err, res){
49        if(err) console.log(err);
50        console.log(res);
51      });
52
53    });
54  }
```

API를 어떻게 활용할 것인가? - Node.js를 활용한 코드 (4/5)

```
77  var parser = parse({delimiter: ','}, function (err, data) {
78    async.eachSeries(data, function (line, callback) {
79      predict(function(){
80        callback();
81      }, line);
82    }, function(err){
83      var file = fs.createWriteStream('array.csv');
84      file.on('error', function(err) { console.log(err); });
85
86      resultArr.forEach(function(v) {
87        console.log(v);
88        file.write(v.join(', ') + '\n'); });
89      file.end();
90    })
91  })
92
93  var stream = fs.createReadStream(inputFile).pipe(parser);
94
```

API를 어떻게 활용할 것인가? - Node.js를 활용한 코드 (5/5)

시행착오…

Linear Data
- 연속형 데이터 추정의 경우 100만 건을 학습시켰을 때 시간이 오래 걸림(정확히는 알 수 없으나 3시간 정도 걸린 것 같음..)
- 70만 건을 학습시켰을 때, time limit exceeded 에러가 나면서 학습이 되지 않음
- 새로운 데이터에 대한 적용 -> 포기(죄송 ㅠㅠ)

```
D:₩01 Study₩07 Nodejs>node get.js
{ kind: 'prediction#training',
  id: 'random-regression',
  selfLink: 'https://www.googleapis.com/prediction/v1.6/projects/test-project-16
0901/trainedmodels/random-regression',
  created: '2017-03-14T06:43:27.656Z',
  modelInfo: { numberInstances: '0' },
  trainingStatus: 'ERROR: TRAINING TIME LIMIT EXCEEDED' }
```

Binary Data
- 70만 건을 학습시켰을 때, 다행히 시간이 오래 걸리지 않음(10분 내외)
- 정확도도 0.94로 아주 높음
- 그러나 나머지 데이터에 적용했을 때는..?
- 5000건에 대해서 수행했을 때, 4699건을 정확하게 예측하여 정확도 0.9398로 거의 정확하게 예측

Google Cloud Platform Machine Learning API는?

Google Cloud Platform Machine Learning API는? (1/5)

1. Google Prediction API: a Machine Learning black box for developers
 - 내부 알고리즘을 알 수 없음
 - 알고리즘의 Parameter 설정을 할 수 없음
 => Data를 이용한 모델(블랙박스) 생성과 예측만이 가능함

https://www.quora.com/What-algorithms-underlie-the-Google-Prediction-API

What algorithms underlie the Google Prediction API?

Prediction API 알고리즘이 뭐니?

It says it "automatically selects from several available machine learning techniques", but does anyone have a good sense of what these techniques are?

Brandon Ballinger, applied ML to fraud, speech recognition, and ads
Written Jul 16, 2011

아마 Linear model인 것 같아..

Users have reported that the Prediction API has trouble learning XOR, which suggests a linear model--I'd guess they've implemented the most common linear classifiers like logistic regression, naive bayes, and SVMs.

Zachary Goldberg
Written Oct 13, 2011

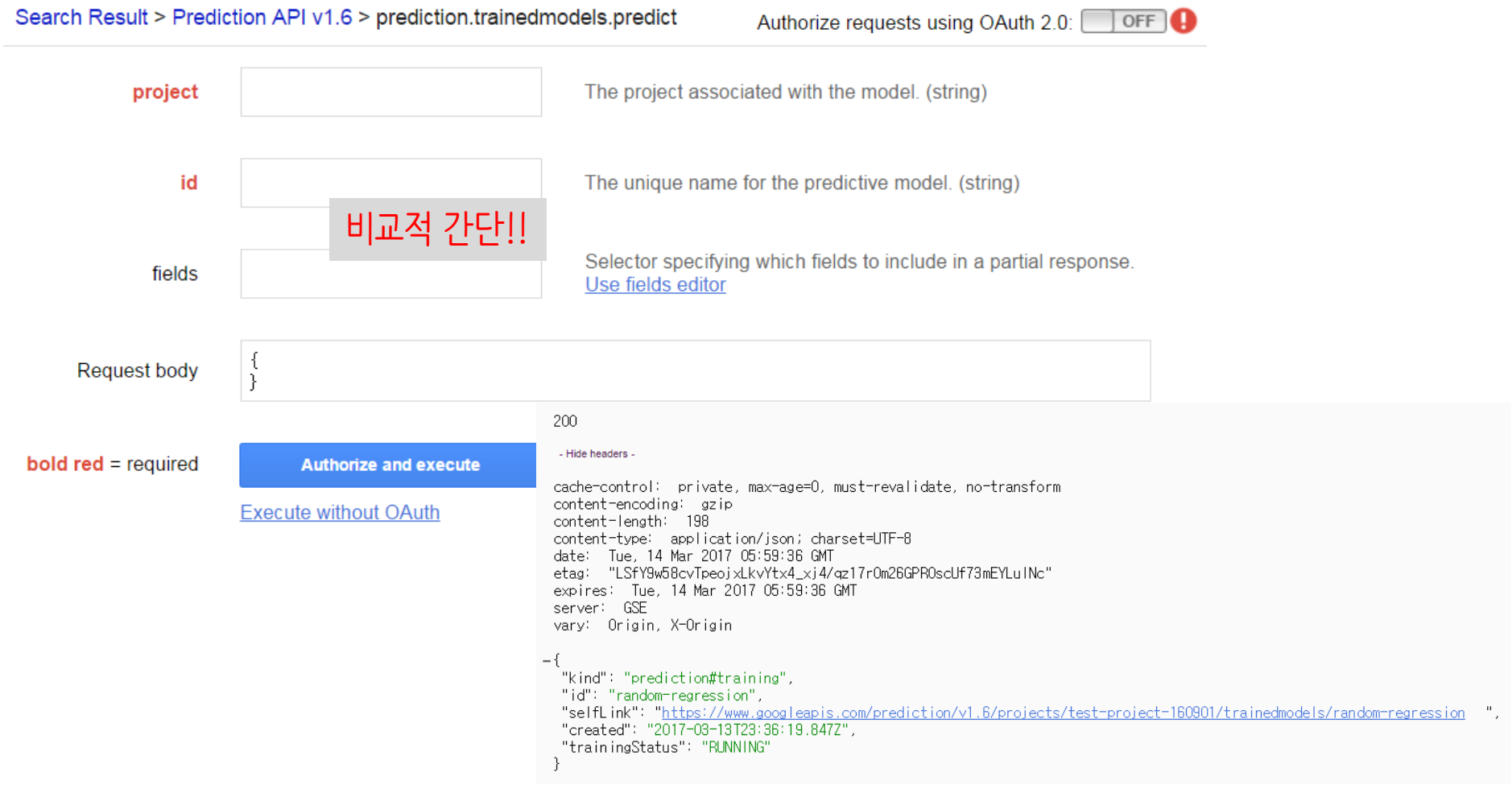
우리는 여러 알고리즘을 가지고 있고 추가해가고 있어. 어려움이 있으면 연락 줘.

Hi! PM for the Prediction API at Google here :). We have quite a few algorithms underlying the Prediction API and we're constantly adding new ones. If you have a use case that you're having trouble getting good results with please do write to us at prediction-api-discuss@googlegro... and we'll see if we can find out why!

Happy Predicting,
-Zach

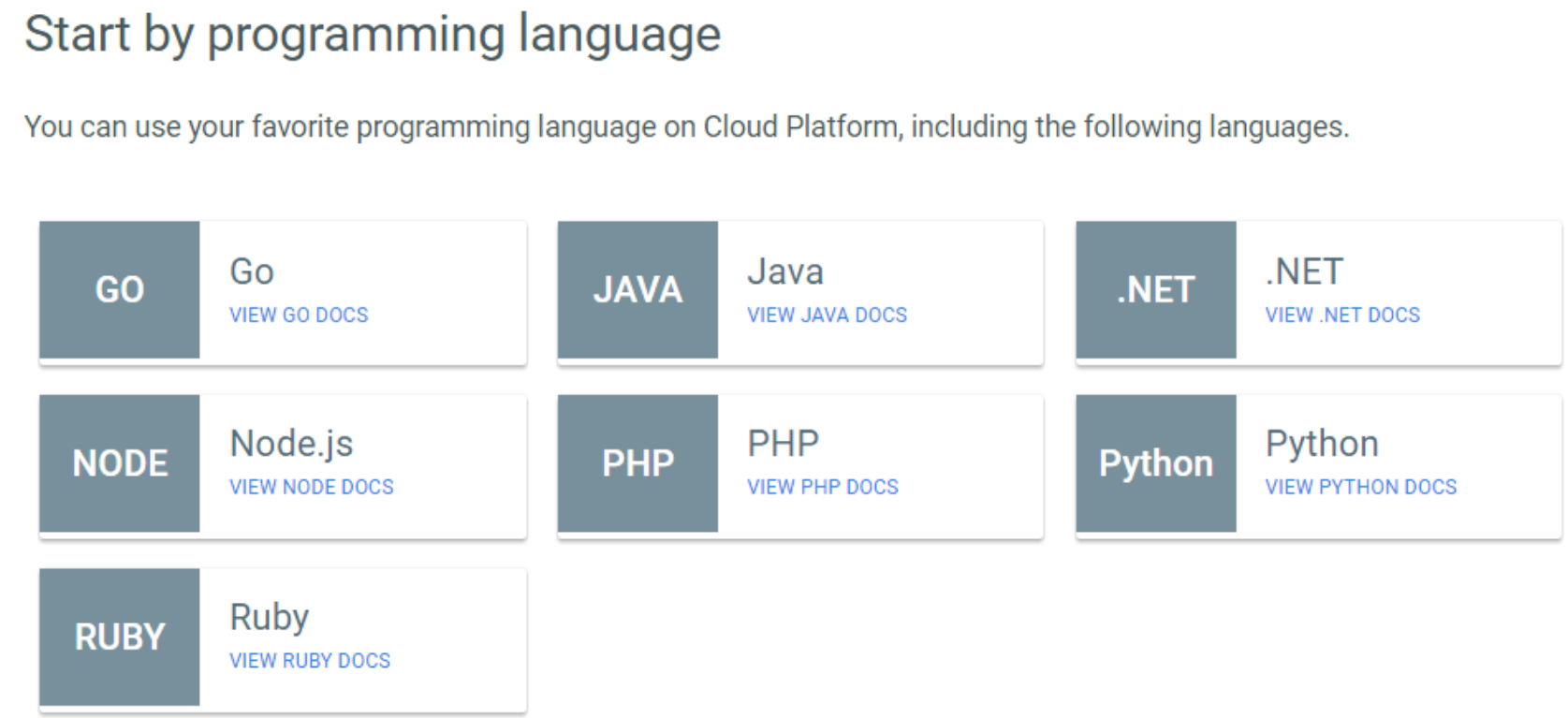
Google Cloud Platform Machine Learning API는? (2/5)

2. Less friendly Interface
 - RESTful API
 - Not Browser Interface
 => 그래도 Explorer API 때문에 단건 데이터에 대해 요청을 보낼 때는 비교적 쉽고, JSON 파일을 해석하는 것이 어렵지 않고 파싱(parsing)도 하면 됨



Google Cloud Platform Machine Learning API는? (3/5)

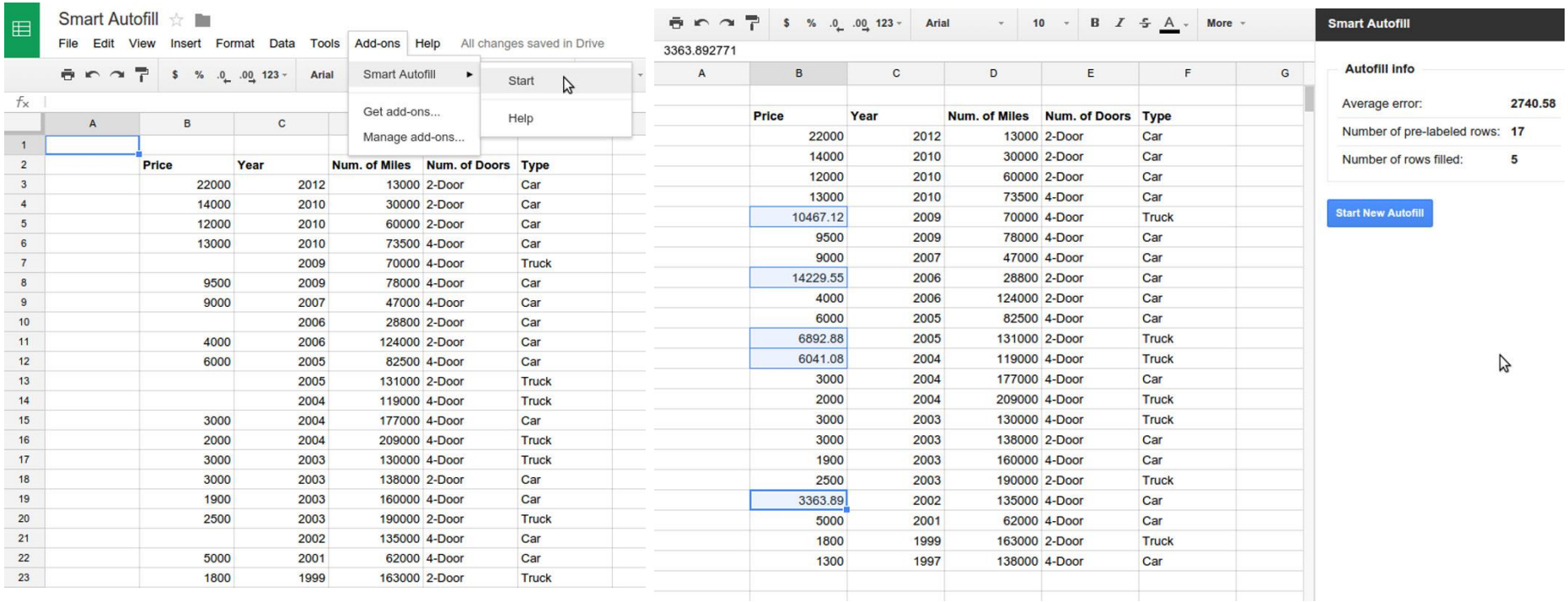
3. Language support
 - ~~어떤 언어이든 사용 가능? R이나 Matlab 등등 mathwork이나 분석을 위한 언어는 API 쓰기 어려울 것으로 판단됨~~
 - sample code가 있는 언어는 Go, Java, .NET, Node.js, PHP, Python, Ruby
 => 웹을 다루기(?) 위해서 Python 역량을 키울 필요가 있다고 판단됨



Google Cloud Platform Machine Learning API는? (4/5)

4. Not for analysis, For App
 - 내부 알고리즘이 비공개인 것으로 판단되고, 파라미터(parameter) 조정도 할 수 없기 때문에 분석이나 실험을 위해 쓰기는 어려움
 - 분석에 이용한다면, missing value 처리에 쓸 수도 있으나 모델이 비공개이므로 공격의 가능성 있음
 - 빅데이터 분석 platform, service 또는 App을 위한 API임
 => 빅데이터 분석 platform, service 또는 App을 위해서 이용되기 좋음

https://cloud.google.com/prediction/docs/smart_autofill_add_on

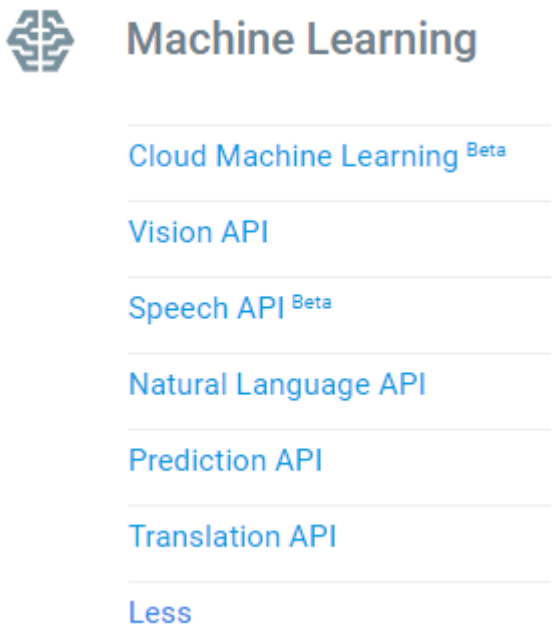


	Price	Year	Num. of Miles	Num. of Doors	Type
3	22000	2012	13000	2-Door	Car
4	14000	2010	30000	2-Door	Car
5	12000	2010	60000	2-Door	Car
6	13000	2010	73500	4-Door	Car
7		2009	70000	4-Door	Truck
8	9500	2009	78000	4-Door	Car
9	9000	2007	47000	4-Door	Car
10		2006	28800	2-Door	Car
11	4000	2006	124000	2-Door	Car
12	6000	2005	82500	4-Door	Car
13		2005	131000	2-Door	Truck
14		2004	119000	4-Door	Truck
15	3000	2004	177000	4-Door	Car
16	2000	2004	209000	4-Door	Truck
17	3000	2003	130000	4-Door	Truck
18	3000	2003	138000	2-Door	Car
19	1900	2003	160000	4-Door	Car
20	2500	2003	190000	2-Door	Truck
21		2002	135000	4-Door	Car
22	5000	2001	62000	4-Door	Car
23	1800	1999	163000	2-Door	Truck

	Price	Year	Num. of Miles	Num. of Doors	Type
	22000	2012	13000	2-Door	Car
	14000	2010	30000	2-Door	Car
	12000	2010	60000	2-Door	Car
	13000	2010	73500	4-Door	Car
	10467.12	2009	70000	4-Door	Truck
	9500	2009	78000	4-Door	Car
	9000	2007	47000	4-Door	Car
	14229.55	2006	28800	2-Door	Car
	4000	2006	124000	2-Door	Car
	6000	2005	82500	4-Door	Car
	6892.88	2005	131000	2-Door	Truck
	6041.08	2004	119000	4-Door	Truck
	3000	2004	177000	4-Door	Car
	2000	2004	209000	4-Door	Truck
	3000	2003	130000	4-Door	Truck
	3000	2003	138000	2-Door	Car
	1900	2003	160000	4-Door	Car
	2500	2003	190000	2-Door	Truck
	3363.89	2002	135000	4-Door	Car
	5000	2001	62000	4-Door	Car
	1800	1999	163000	2-Door	Truck
	1300	1997	138000	4-Door	Car

Google Cloud Platform Machine Learning API는? (5/5)

5. 다른 API
 - API마다 parameter의 차이는 있을 수 있지만, 다른 API들도 작동원리, 인증 방식 등이 같은 것으로 판단됨
 - 데이터가 있고, 분석하고 싶은 API가 있을 경우 다른 API도 쉽게 이용 가능할 것으로 판단됨
 => 다른 API들도 쉽게 이용할 수 있을 것으로 판단됨



Pricing

- **Usage fees:**
  - **Prediction:**
    - **10,000** predictions/month: $0.00
    - **10,001+** predictions/month: $0.50/1,000 predictions beyond the initial 10,000
  - **Training:**
    - **$0.002/MB bulk trained** (maximum size of each dataset: 2.5GB)
    - **0-10,000 streaming updates:** $0.00
    - **10,001+ streaming updates:** $0.05/1,000 updates beyond the initial 10,000.
- **Usage limits:**
  - If you intend to make more than 40,000 predictions/day, please contact us.
  - Google Prediction has a default limit of 2,000,000 predictions/day per project for your own models.
  - Hosted models have a usage limit of 1 models. Developers can set higher pai model's documentation for more detai

Storage

General Pricing

Multi-Regional Storage (per GB per Month)	Regional Storage (per GB per Month)	Nearline Storage (per GB per Month)	Coldline Storage (per GB per Month)
$0.026	$0.02	$0.01	$0.007

Japan (asia-northeast1) Region Pricing

Regional Storage (per GB per Month)	Nearline Storage (per GB per Month)	Coldline Storage (per GB per Month)
$0.023	$0.016	$0.01

Thank you.