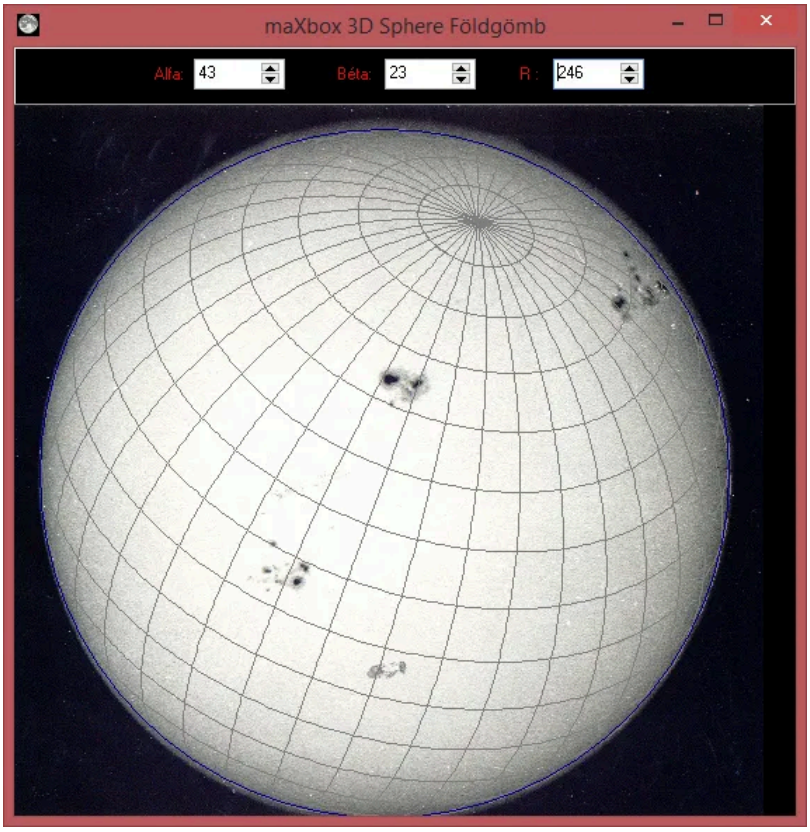
Board Game Regressor

Max Kleiner 10 min read · Nov 20, 2020

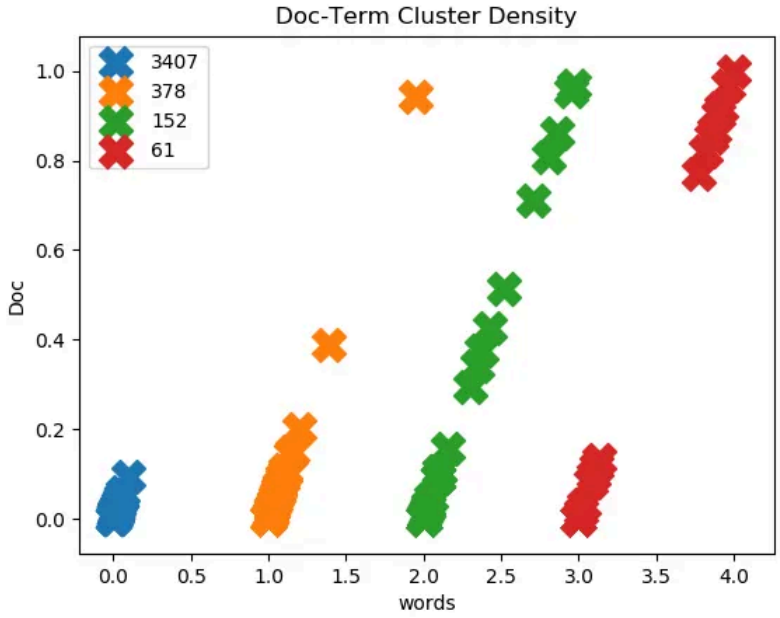


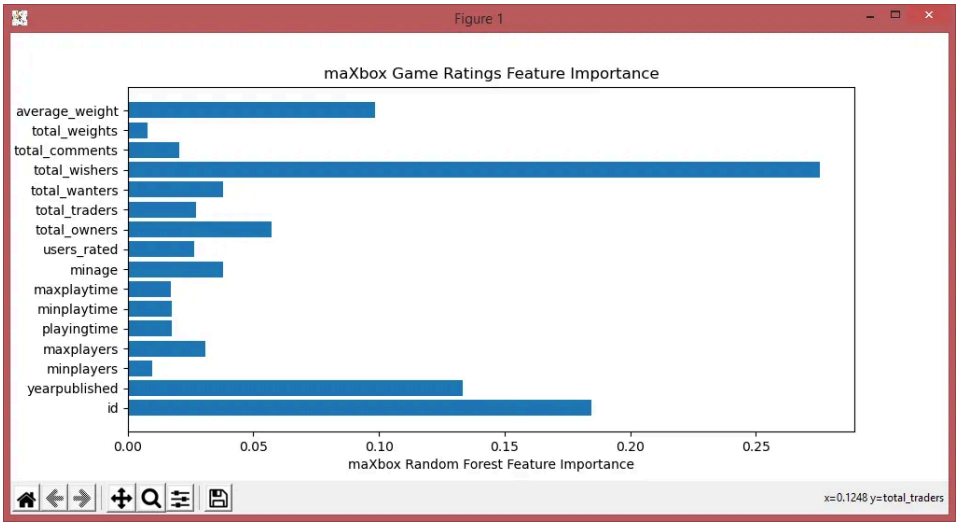
Before we dive into machine learning, we're going to explore a dataset, and figure out what might be interesting to predict. The dataset is from

BoardGameGeek, and contains data on `80000` board games. Here's a single boardgame on the site. This information was kindly scraped into *csv* format by Sean Beck, and can be downloaded here. The dataset contains several data points about each board game.

https://www.dataquest.io/blog/machine-learning-python

The first step in our exploration is to read in the data and print some quick summary statistics and we enhanced the tutorial with a decision tree feature importance.





One of the nice things about Scikit-learn is that it enables us to try more powerful algorithms very easily. One such algorithm is called

random forest. The random forest algorithm can find nonlinearities in data that a linear regression wouldn't be able to pick up on.

```
import re, math from collections import Counter import numpy as np import pandas
```

```
import re, math
from collections import Counter
import numpy as np
import pandas
import matplotlib.pyplot as plt

text1 = 'How can I be a geologist?'
text2 = 'What should I do to be a geologist?'
```

```
class Similarity():
    def compute_cosine_similarity(self, string1, string2):
         print(string1, string2)
         # intersects the words that are common
         # in the set of the two words
         intersection = set(string1.keys()) & set(string2.keys())
         # dot matrix of vec1 and vec2
         numerator = sum([string1[x] * string2[x] for x in intersection])

         # sum of the squares of each vector
         # sum1 is the sum of text1 and same for sum2 for text2
         sum1 = sum([string1[x]**2 for x in string1.keys()])
         sum2 = sum([string2[x]**2 for x in string2.keys()])

         # product of the square root of both sum(s)
         denominator = math.sqrt(sum1) * math.sqrt(sum2)
         if not denominator:
            return 0.0
         else:
            return round(numerator/float(denominator),4)

    def text_to_vector(self,text):
        WORD = re.compile(r'\w+')
        words = WORD.findall(text)
        print(words)
        return Counter(words)

    def text_to_vector2(self,atext):
        atex = atext.lower().split(" ")
        print(atex)
        return Counter(atex)

    # Jaccard Similarity
    def tokenize(self,string):
        return string.lower().split(" ")

    def tokenize2(self,string):
        return string.lower().split(" ")

    def jaccard_similarity(self, string1, string2):
        intersection = set(string1).intersection(set(string2))
        union = set(string1).union(set(string2))
        return len(intersection)/float(len(union))

similarity = Similarity()

# vector space
vector1 = similarity.text_to_vector2(text1)
vector2 = similarity.text_to_vector2(text2)

# split words into tokens
token1 = similarity.tokenize2(text1)
token2 = similarity.tokenize2(text2)

cosine = similarity.compute_cosine_similarity(vector1, vector2)
print ('Cosine Similarity:', cosine)

jaccard = similarity.jaccard_similarity(token1,token2)
print ('Jaccard Similarity:', jaccard)

#https://www.dataquest.io/blog/machine-learning-python/

games = pandas.read_csv(r"C:\maXbox\mX46210\DataScience\games.csv")
# Print the nameof the columns in games.
print(games.columns)
print(games.shape)

#plt.hist(games["average_rating"])
#plt.show()

games[games["average_rating"] == 0]
print(games[games["average_rating"] == 0].iloc[0])

games = games[games["users_rated"] > 0]
# Remove any rowy with missing values.
games = games.dropna(axis=0)
```

```
print(games.shape)

from sklearn.cluster import KMeans

kmeans_model = KMeans(n_clusters=5, random_state=1)
good_columns = games._get_numeric_data()
kmeans_model.fit(good_columns)
labels = kmeans_model.labels_
#centroids = kmeans_model.centroids_
print(labels)

#print(kmeans_model.cluster_centers_)
centers = np.array(kmeans_model.cluster_centers_)

plt.plot()
plt.title('maXbox k-means centroids')
colors = ['b', 'g', 'c','r','y']
markers = ['o', 'v', 's']

"""
x1 = np.array([3, 1, 1, 2, 1, 6, 6, 6, 5, 6, 7, 8, 9, 8, 9, 9, 8])
x2 = np.array([5, 4, 6, 6, 5, 8, 6, 7, 6, 7, 1, 2, 1, 2, 3, 2, 3])
"""
#"""
#label = kmeans_model.fit_predict(good_columns)
#print(label)
X= good_columns.values
u_labels = np.unique(labels)
for i in u_labels:          #(u_labels, kmeans_model.labels_):
    #plt.plot(labels[:i,0], labels[:i,1], color=colors[l], marker=markers[l],ls=
    plt.scatter(X[labels == i ,0] , \
                X[labels == i ,1],color=colors[i],label=u_labels[i]) #color=colo
    # plt.scatter(centers[:,0], centers[:,1], marker="x", color=colors)
    #plt.xlim([0, 10])
    #plt.ylim([0, 10])
#"""
#plt.scatter(centers[:,0], centers[:,1], marker="x", color='r')
plt.scatter(centers[:,0] ,centers[:,1], marker="x", s= 250, color= 'k') #'k' - c
plt.legend()
plt.show()

from sklearn.decomposition import PCA

#"""
pca_2 = PCA(3)  #2 or 3?
plt.title('maXbox PCA fit_transform')
plot_columns = pca_2.fit_transform(good_columns)
plt.scatter(x=plot_columns[:,0], y=plot_columns[:,1], c=labels)
# plt.scatter(centers[:,0], centers[:,1], marker="x", color='b')
plt.show()
#"""
print(games.corr()["average_rating"])

# Get all the columns from the dataframe.
columns = games.columns.tolist()
# Filter the columns to remove ones we don't want.
columns = [c for c in columns if c not in ["bayes_average_rating","average_ratin

# Store the variable we'll be predicting on.
target = "average_rating"

# Import a convenience function to split the sets.
from sklearn.model_selection import train_test_split

# Generate the training set.  Set random_state to be able to replicate results.
train = games.sample(frac=0.8, random_state=1)
# Select anything not in the training set and put it in the testing set.
test = games.loc[~games.index.isin(train.index)]
# Print the shapes of both sets.
print('train shape: ',train.shape)
print('test shape: ',test.shape)

# Import the linearregression model.
from sklearn.linear_model import LinearRegression

# Initialize the model class.
```

```
model = LinearRegression()
# Fit the model to the training data.
model.fit(train[columns], train[target])

# Import the scikit-learn function to compute error.
from sklearn.metrics import mean_squared_error
# Generate our predictions for the test set.
predictions = model.predict(test[columns])
# Compute error between our test predictions and the actual values.
print(mean_squared_error(predictions, test[target]))
print(mean_squared_error(test[target], predictions))

from sklearn.metrics import r2_score
print(r2_score(test[target], predictions))

# Import the random forest model.
from sklearn.ensemble import RandomForestRegressor

# Initialize the model with some parameters.
model = RandomForestRegressor(n_estimators=100, min_samples_leaf=10, random_stat
# Fit the model to the data.
model.fit(train[columns], train[target])
# Make predictions.
predictions = model.predict(test[columns])
# Compute the error.
print('mse ',mean_squared_error(predictions, test[target]))
print('r2 ',r2_score(test[target], predictions))

plt.title('maXbox Game Ratings Feature Importance')
#print(model.feature_importances_)
plt.xlabel("maXbox Random Forest Feature Importance")
plt.barh(columns, model.feature_importances_)
#plt.show()
sorted_idx = model.feature_importances_.argsort()
#TypeError: only integer scalar arrays can be converted to a scalar index
# plt.barh(np.array([columns[sorted_idx]]), model.feature_importances_[sorted_id
#plt.barh(columns[sorted_idx], list(model.feature_importances_[sorted_idx]))
#plt.xlabel("maXbox Random Forest Feature Importance")
plt.show()


#https://github.com/ThaWeatherman/scrapers/blob/master/boardgamegeek/spider.py
#https://mljar.com/blog/feature-importance-in-random-forest/
#----app_template_loaded_code----
#----File newtemplate.txt not exists - now saved!----
```

And the output:

C:\maXbox\mX46210\maxbox4>py
..\DataScience\gamegeek_similarity_py.txt
[‘how’, ‘can’, ‘i’, ‘be’, ‘a’, ‘geologist?’]
[‘what’, ‘should’, ‘i’, ‘do’, ‘to’, ‘be’, ‘a’, ‘geologist?’]
Counter({‘how’: 1, ‘can’: 1, ‘i’: 1, ‘be’: 1, ‘a’: 1, ‘geologist?’: 1}) Coun
{‘what’: 1, ‘should’: 1, ‘i’: 1, ‘do’: 1, ‘to’: 1, ‘be’: 1, ‘a’: 1, ‘geologi: 1})
Cosine Similarity: 0.5774
Jaccard Similarity: 0.4
Index([‘id’, ‘type’, ‘name’, ‘yearpublished’, ‘minplayers’, ‘maxplayers’,
‘playingtime’, ‘minplaytime’, ‘maxplaytime’, ‘minage’, ‘users_rated’,
‘average_rating’, ‘bayes_average_rating’, ‘total_owners’,
‘total_traders’, ‘total_wanters’, ‘total_wishers’, ‘total_comments’,
‘total_weights’, ‘average_weight’],
dtype=’object’)

```
(81312, 20)
id 318
type boardgame
name Looney Leo
yearpublished 0
minplayers 0
maxplayers 0
playingtime 0
minplaytime 0
maxplaytime 0
minage 0
users_rated 0
average_rating 0
bayes_average_rating 0
total_owners 0
total_traders 0
total_wanters 0
total_wishers 1
total_comments 0
total_weights 0
average_weight 0
Name: 13048, dtype: object
(56894, 20)
[2 1 1 ... 4 4 4]
id 0.304201
yearpublished 0.108461
minplayers -0.032701
maxplayers -0.008335
playingtime 0.048994
minplaytime 0.043985
maxplaytime 0.048994
minage 0.210049
users_rated 0.112564
average_rating 1.000000
bayes_average_rating 0.231563
total_owners 0.137478
total_traders 0.119452
total_wanters 0.196566
total_wishers 0.171375
total_comments 0.123714
total_weights 0.109691
average_weight 0.351081
Name: average_rating, dtype: float64
train shape: (45515, 20)
test shape: (11379, 20)
1.8239281903519875
```

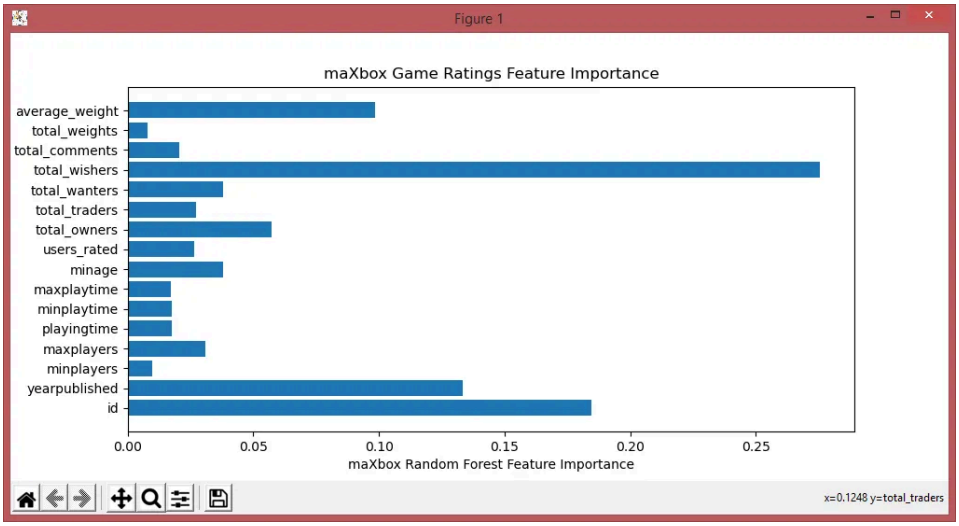
1.8239281903519875

0.268394771387396

mse 1.414465540054245

r2 0.4326364435453288

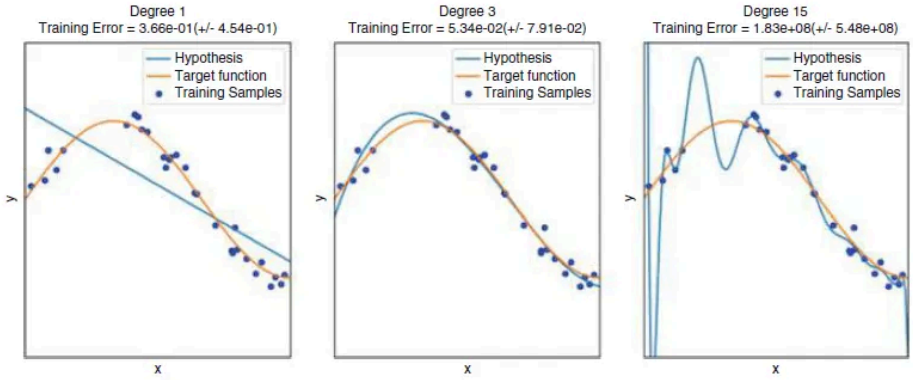
C:\maXbox\mX46210\maxbox4>



Below, we exploit the fact that every Pandas row has a unique index to select any row not in the training set to be in the testing set.

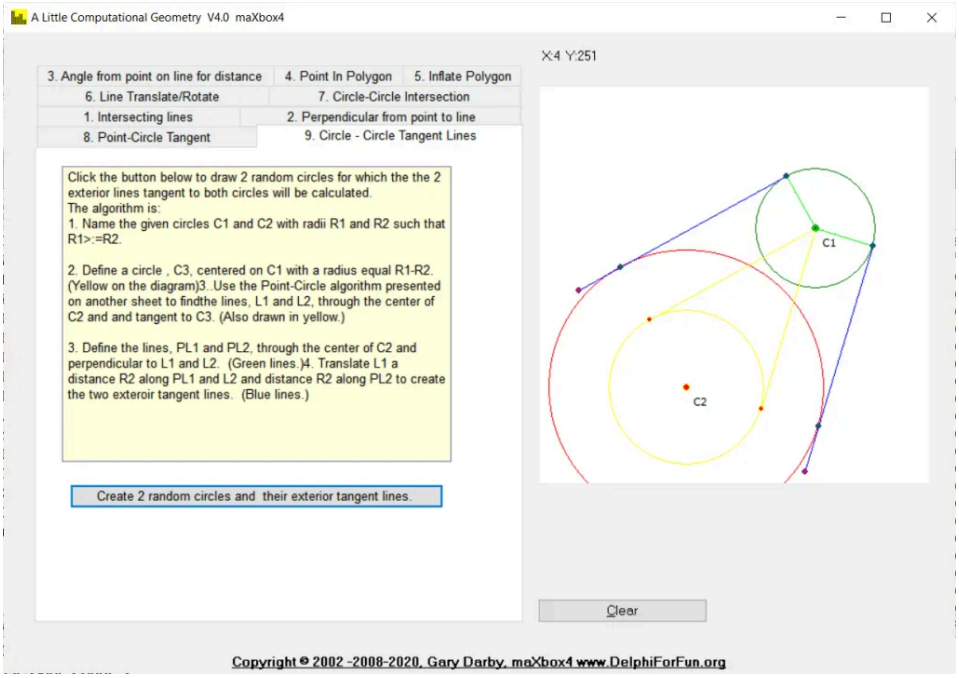
```
# Generate training set. Set random_state to be able to replicate results. train
```

```
# Generate training set. Set random_state to be able to replicate results.
train = games.sample(frac=0.8, random_state=1)
# Select anything not in the training set and put it in the testing set.
test = games.loc[~games.index.isin(train.index)]
# ~ means Not!
```



Fitting a target function with different-degree polynomials — Deep Learning for NLP and Speech Recognition, Springer 2018,

Given a line and a point not on the line, construct a line through the point and perpendicular to the line. The trick here is to determine the slope of the given line, **m**, and take advantage of the fact that the slope of a perpendicular line is **-1/m.**

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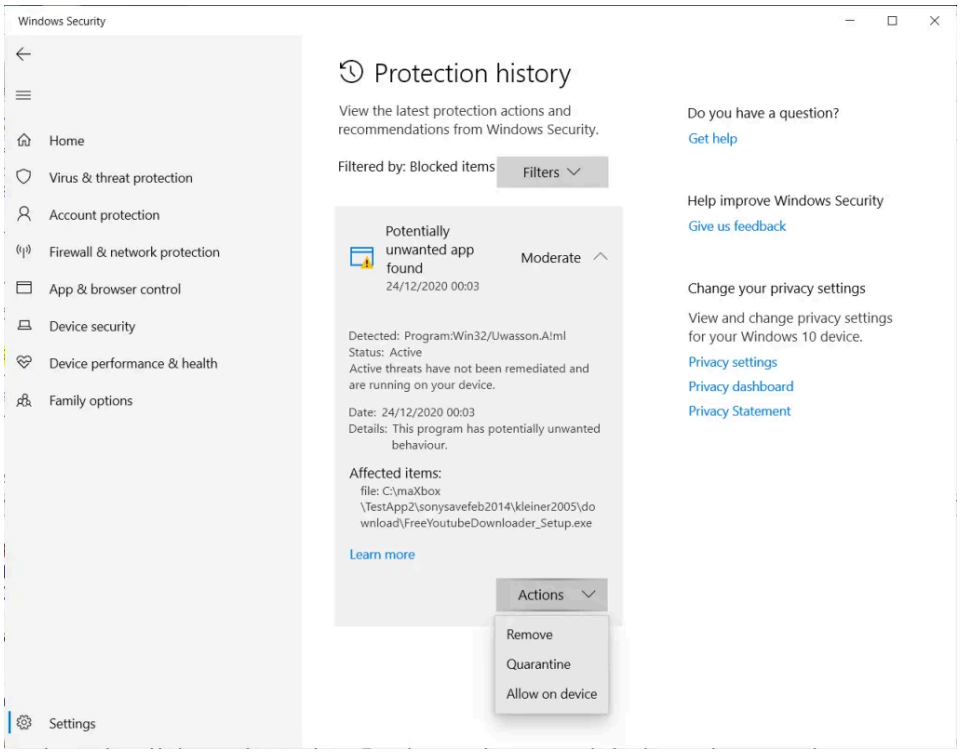

Interessant zu wissen ist, dass die Re 4/4 I 10033 2.Serie die letzte **in** der TEE Lackierung war. Es waren ja die vier Lok Nr. 10033, 10034, 10046 und 10050 mit rot/beigen Anstrich.

Il est intéressant de noter que la Re 4/4 I 10033 de la 2e série fut la dernière à arborer la livrée TEE. Quatre locomotives, les numéros 10033, 10034, 10046 et 10050, étaient peintes en rouge et beige.

Die CC 6511 war eine der letzten 1,5-kV-Lokomotiven, die man ohne Leistungselektronik entwickelt hat.

Sie konnte sowohl Personenzüge mit 200 km/h als auch Güterzüge mit 100 km/h ziehen. Ihr Design basiert auf den ursprünglichen “nez cassés” (gebrochene Nasen als Anspielung auf die geneigten Windschutzscheiben) der CC 40100, die ebenfalls von Paul Arzens gestaltet wurden.

Aus Katalog 1982 K.P.E.V. — Königlich Preußische Eisenbahn-Verwaltung Beschreibung:Personenwagen/Durchgangswagen, 2-achsig, 1. Klasse, beige (creme)/rot Bemerkung:mit Fantasielackierung einer imaginären Privatbahn, Zuglaufschild ´Central´

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Written by Max Kleiner

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Max Kleiner's professional environment is in the areas of OOP, UML and coding - among other things as a trainer, developer and consultant.

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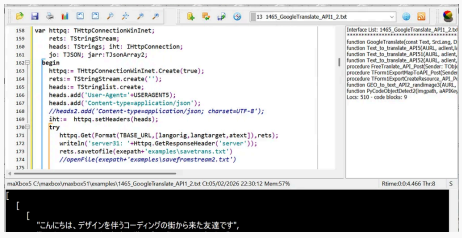

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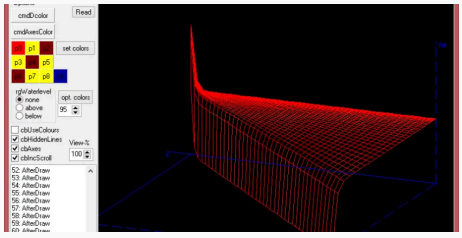

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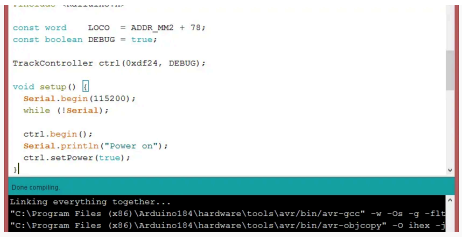

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