Configuration Manual

MSc Research Project
MSc FINTECH

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Project Submission Sheet
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Configuration Manual

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1 Introduction

This document is drafted to facilitate the replication of the experiment carried out in the corresponding research Impact of Road surface condition. Implementation of the experiment is discussed over in detail in this work. It is intended to guide the reader to replicate the experiment and arrive at the same results.

2 Data sets

There are two datasets that have been acquired for this research. Road Safety Authority (RSA) of Ireland's Historic road collision dataset acquired by the Garda Síochána during the reporting of a road collision event. The dataset had been acquired by placing an academic request to the research department at RSA.

The second dataset is the SCRIM assessment dataset available publicly in Transport Infrastructure Ireland's (TII) public data repository. The SCRIM assessment is an yearly assessment performed by the TII and is made available in the public data repository. The most recent record of the assessment is chosen for appropriate results. It is important to correlate the historic collision dataset's timeframe with the time frame of SCRIM assessment dataset.

3 Hardware Requirements

Processor Requirement: Intel® Core™ i7-4700MQ/ equivalent and above

Memory Requirement: At least 16 GB

GPU Requirement: Recommended NVIDIA GeForce GT 750M 2GB. Not mandatory.

Operating System: Linux, Mac OS X, Windows – 64bit OS, x64 Architecture

4 Software Requirements

Python version: 3.7 and above

Jupyter Notebook: 2017 and later

Libraries used: Matplotlib, Pandas, Scikit, Numpy

Google Earth Pro (Desktop): 7.3.3.7786 (Alternatively could choose ArcGIS pro)

5 Replication

- Check for the hardware and software requirements, if there are hardware constraints consider a cloud-based instance with a configuration as mentioned.
- The datasets are acquired from the respective sources and are analyzed for data quality. The geolocation of incents and records may be in Irish Transverse Mercator and has to be converted WSG40 universal format.
- Export the data frame with the changes needed for purposes of modelling.
- Plot the features on Google Earth/ ArcGIS pro for geospatial analysis & visualization.
- Follow the code specified as follows.

6 Code

Transformation function for ITM to WSG40,

```
# Meridian Arc
def arcmer(a,equad,lat1,lat2):

    b=a*sqrt(1-equad)

    n=(a-b)/(a+b)

    a0=1.+((n**2)/4.)+((n**4)/64.)

    a2=(3./2.)*(n-((n**3)/8.))

    a4=(15./16.)*((n**2)-((n**4)/4.))

    a6=(35./48.)*(n**3)



    s1=a/(1+n)*(a0*lat1-a2*sin(2.*lat1)+a4*sin(4.*lat1)-a6*sin(6.*lat1))

    s2=a/(1+n)*(a0*lat2-a2*sin(2.*lat2)+a4*sin(4.*lat2)-a6*sin(6.*lat2))

    return s2-s1
```

```
# Transverse Mercator Inverse Projection
def xy2geo(m,p,a,equad,lat0,lon0):

    lat0=radians(lat0)
    lon0=radians(lon0)

    sigma1=p

    fil=lat0+sigma1/(a*(1-equad))

    deltafi=1

    while deltafi > 0.0000000001:

        sigma2=arcmer(a,equad,lat0,fil)

        RO=a*(1-equad)/((1-equad*(sin(fil)**2))**(3./2.))

        deltafi=(sigma1-sigma2)/RO

        fil=fil+deltafi


    N=a/sqrt(1-equad*(sin(fil))**2)

    RO=a*(1-equad)/((1-equad*(sin(fil)**2))**(3./2.))

    t=tan(fil)

    psi=N/RO

    lat=fil-(t/RO)*((m**2)/(2.*N))+(t/RO)*((m**4)/(24.*(N**3)))*(-4.*(psi**2)-9.*psi*(1.-
        t**2)+12.*(t**2))-(t/RO)*(m**6/(720.*(N**5)))*(8.*(psi**4)*(11.-24.*(t**2))-
        12.*(psi**3)*(21.-71.*(t**2))+15.*(psi**2)*(15.-
```

```
        98.*(t**2)+15.*(t**4))+180.*psi*(5.*(t**2)-3.*(t**4))-
        360.*(t**4))+(t/RO)*((m**8)/(40320.*(N**7)))*(1385.+3633.*(t**2)+4095.*(t**4)+1
        575.*(t**6))

    lon=(m/(N))-((m**3)/(6.*(N**3)))*(psi+2.*(t**2))+((m**5)/(120.*(N**5)))*(-
        4.*(psi**3)*(1.-6.*(t**2))+(psi**2)*(9.-68.*(t**2))+72.*psi*(t**2)+24.*(t**4))-
        ((m**7)/(5040.*(N**7)))*(61.+662.*(t**2)+1320.*(t**4)+720.*(t**6))

    lon=lon0+lon/cos(fil)

    lat=degrees(lat)
    lon=degrees(lon)

    return lat,lon


# Irish Transverse Mercator - Inverse

def itm2geo(x,y):

    # GRS-80

    a = 6378137.

    equad =0.00669437999

    # Natural Origin

    lat0=53.5

    lon0=-8.

    k0=0.999820

    p = (y - 750000.) /k0
```

```
    m = (x - 600000.) /k0

    lat,lon = xy2geo(m,p,a,equad,lat0,lon0)

    return lat,lon

# Testing conversion from ITM to WSG40
test = itm2geo(619392.4,828755.7)

print ("latitude= %.16f" %test[0])
        print ("longitude= %.16f" %test[1])
```

Using Transformation across records for both Datasets,

```
#Transforming ITM to WGS84 for all indexes
for i in CSC.index:
    test = itm2geo(CSC.ITM_E[i],CSC.ITM_N[i])
    CSC.ITM_E[i]=test[0]
    CSC.ITM_N[i]=test[1]
CSC.columns = ['csc', 'lat', 'long']

#Exporting Scrim Resistance as CSV
CSC.to_csv(r'SC_Transform.csv', index = False)
```

Split Collision dataset into Train and Test Data,

```
dep_Y = select.type
indep_X = select.surface
X_train, X_test, y_train, y_test = train_test_split(indep_X, dep_Y,
train_size=0.8,test_size=0.2, random_state=101)
```

Naïve Bayes Model using Train dataset,

```
model = GaussianNB()

# fit the model with the training data
model.fit(X_train,y_train)

# predict the target on the train dataset
predict_train = model.predict(X_train)
print('Target on train data',predict_train)
```

```
# Accuray Score on train dataset
accuracy_train = accuracy_score(y_train,predict_train)
print('accuracy_score on train dataset : ', accuracy_train)
```

Prediction using test dataset,

```
# predict the target on the test dataset
predict_test = model.predict(X_test)
print('Target on test data',predict_test)
```

Evaluating performance Accuracy, Precision, Recall & F1 Score,

```
# Accuracy Score on test dataset
print("Accuracy score of test dataset: ",metrics.accuracy_score(y_test,predict_test))

#Precision Score on test Dataset
print("Precision score of test dataset: ",metrics.precision_score(y_test,predict_test,
average='macro'))

#Recall Score in test Dataset
print("Recall score of test dataset: ",metrics.recall_score(y_test,predict_test,
average='macro'))

#F1 Score in test Dataset
print("F1 score of test dataset: ",metrics.f1_score(y_test,predict_test, average='macro'))
```

Foot note:

1. Transport Infrastructure Ireland data repository - http://data.tii.ie/#roadsafety
2. Road Safety Authority of Ireland, Research department's Road collision dataset- https://www.rsa.ie/en/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Ireland-Road-Collisions/