**VisvesvarayaiTechnologicaliUniversity**

**Belgaum,iKarnataka-i590014**

## AiProjectiReportiOn

**“Realitimeishareimarketianalysisiusingimachineilearning”**

SubmittediinitheipartialifulfilmentiofitheirequirementsiforitheiawardiofitheiDegreeiof

## BACHELORiOFiENGINEERING

In

## INFORMATIONiSCIENCEiANDiENGINEERING

**ACCREDITEDiBYiNBA**

Submittediby

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2019-2020

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2019-2020

**Certificate**

ThisiisitoicertifyithatitheiProjectiWorkientitledi-**“RealiTimeiShareimarketianalysisiusingimachineilearning”i**isiaibonafideiworkicarriedioutibyi**BasavarajiSavalagii**(1DS17IS402),i**DeepakikumariNi**(1DS17IS405),i**GirishibabuiJNi**(1DS17IS407),iandi**MohammediSufiyaaniBaigi**(1DS17IS413)iinipartialifulfilmentiforithei8thisemesteriofiBacheloriofiEngineeringiiniInformationiSciencei&iEngineeringiofitheiVisvesvarayaiTechnologicaliUniversity,iBelgaumiduringitheiyeari2019-2020.iTheiProjectiReportihasibeeniapprovediasiitisatisfiesitheiacademicsiprescribediforitheiBacheloriofiEngineeringidegree.

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1.i i

2.i i

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Weiareihighlyiindebteditoiouriinternaliguidei**Mrs.iVaidehiiM,i**Asst.iProfessor,iDepartmentiofiInformationiSciencei&iEngineering,iDayanandaiSagariCollegeiofiEngineeringiforihericonstantisupportiandiguidance.isheihasibeeniaigreatisourceiofiinspirationithroughoutitheicourseiofithisiproject.

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**ABSTRACT**

Shareimarketianalysisioripredictioniisidemonstrationiofiattemptingitoidecideitheirealitimeivalueiofiai

Organizationistockioriotherifinancialiinstrumentitradedioniaifinancialiexchangeiusingitoolsianditechniquesi

ofiMachineiLearning.iInithisipaperiweiproposeiaiMachineiLearningiapproachithatiwillibeitrainedifromithe

iaccessibleistocksidataiandigainiintelligenceianditheniusesitheiacquirediknowledgeiforianiexactiprediction.

iThisimodelipredictsitheistockipricesiusingidifferentidatasetsi(foriexample:inasdaqifinance,iyahooifinancei

andigoogleifinance)iandiregressionitechnique.iTheigoaliofithisimodeliisitoianalyzeitheihistoricalidataiandi

predictitheirealitimeistockipricesiaccurately.i

***KeyiWords​:i​****–i****MachineiLearningidatasets,iyahooifinance,igoogleifinance.***

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# CHAPTERi1

**INTRODUCTION**

## 1.1iOverview:

Predictingistocksicorrectlyicanicauseiheavyiandilargeiamountiofiprofitsiforitheivendoriandithereforeithe

dealer,iit’sibeenisaidithatipredictioniisidisorderediinsteadiofiirregular,ithatimeansiit’sipossibleitoipredict

stocksibyianalysisiofipreviousidataiofirespectiveistockimarketicarefully.

WithitheihelpiofiMachineilearningiit’sipossibleitoimakeisuchikindiofiprocess.iItiforecastiaiadvertiseicost

onitheiprecariousiedgeiofisubstantialiworthithereforeiincreasesitheiexactness.iTheiindispensableiaipieceiof

machineilearningiisithatitheicollectioniofidataiutilized.

Theicollectioniofidataishouldibeiasirealiandidefiniteiasipossibleibecauseitouchichangeiinsideitheiinformation

canipropagateienormousichangesiinsideitheiresult.iDeterminingitheistockitradeihasibeeniproblematicifor

financialispecialistsisinceimarket'sipresence.

StockiMarketiandistockitradeiisiwhereiforecastidoesn'tiadhereitoispecificistandardsitoiinquireiaboutithe

valueiofianiofferiinsideitheistockimarket.

Theitwoifinancialispecialistsiandiindustryiareiengagediwithiaccessibleimarketiandineeditoicomprehend

whetheriaiparticulariofferiwouldiriseiorigoioveriaispecificitimeiofiyouritime.iTheieffectiveiforecastiofian

offer'sicostibyiitsiinvestigationicouldileadionitoiaimajoribenefit.iThisiisifrequentlyibeingithroughiwithithe

helpiofiamazinglyienormousinoteworthyiinformationalicollectionsitoidelineateichangingiconditionsiand

therefore,ireaffirmingitheisuppositionithatitheimeasurementidesignsihaveihugeiprescientiforceiwithiaihigh

ilikelihooditoigetiproductiveiexchangesiandisignificantiyieldsiforiinterestiinibusiness.

## 

## 1.2 ProblemiStatement

Foridevelopingianyishareimarketipredictionimodeliinimachineilearning,itheimainichallengeiisitoicollectitheiappropriateiandicorrectidatasetsiforiaccurateianalysisiandipredictioniinimachineilearningimodeliandiselectionioficorrectimachineilearningimodeliisiveryimuchiimportantitoipredictitheicorrectivaluesiofistocks.iifitheicollectedidatasetsiareinotiaccurateiandiincorrectithenitheistockimarketianalysisiandipredictionigoesiwrong.i

## 

## 1.3iObjectives

1. Toicollectiaccurateidatasetsiofivariousiorganizationsiiniorderitoianalyzeiandipredictitheistocksiofithoseiorganization.i
2. Systematicianalysisiofiadvantagesiandidisadvantagesiofiexistingimachineilearningimodeliforishareimarketianalysis.i
3. Developingianimachineilearningimodelitoitrainidataiextractedifromirawidataianditestingitheirawidataiandimakingiititrainedidatairesultsitoipredictitheistockipricei.
4. Deploymentiofitheiefficientimodeliforishareimarketianalysisiusingimachineilearning.i

# CHAPTERi2

**LITERATUREiSURVEY**

VariousiBooksiandiinformationimaterialsifromitheiwebiregardingishareimarketianalysisiusingiMachineilearningihaveibeenistudiedithroughiiniorderitoiachieveitheirequirediinformationiconcernitoithisiproject.iAmongithem,ifollowingiareitheikeyipointsiextractedithrough:

1. Thei**Researchipaperi**oni**shareimarketipredictioni**byi**mehakiusmani,isyedihasaniadil,iandikamranirazai**gaveiusiaibriefiknowledgeiofiRealitimeishareimarketianalysisiusingimachineilearningihelpediusitoichooseitheiappropriateiapproach.

Thisipaperiintroducesiaiconsolidatingiresultsifromichronicledidata,inewsidataiinvestigationiusingiARIMAi(AutoregressiveiIntegratediMovingiAverage)iandiSMA(SimpleiMovingiAverage)iialgorithms.i

1. **TheiResearchipaperi**on**iFutureipredictionsiiniIndianistockimarketithroughilinguistic-temporaliapproach**iby**ipritiisaxenaiandibhaskaripant**igaveiusiaibriefiknowledgeianalyzingitheiforecastiusesirecordediinformationitoidefineifutureiforecastsi

Thisipaperipresentsianalyzingitheiforecastiusesirecordediinformationitoidefineifutureiforecasts.iTheseiforecastsionceiiniaiwhileigetitheistructureiofiabsoluteiresults,iandiareidepicteditoishowitheiconductithaticomparesitoitheibehavioritakingiplaceiinitheifuture.iforecastiisioneiofitheisignificantisituationiinitransientiinformationiminingiinistockimarketianalysis.

1. Thei**Researchipaperi"**i**StockiMarketiForecastingiUsingiHiddeniMarkovi**

**Modeli"ibyimdirafiulihassan,iandibaikunthinath**igives**i**usianiintroductoryiknowledgeionitoiforecastitheistockipricesiforiinterrelatedimarketiHMM.

toiforecastitheistockipricesiforiinterrelatedimarketiiHMMi(HiddeniMarkoviModel)iapproachi

usediipatterniirecognizationiiandiclassificationiproblems.

1. Fromitheii**paperi"Theiimpactiofimicrobloggingidataiforistockimarketiprediction”**ibyi**TiffanyiHui-Kang**iiandigives**i**usianiintroductoryiknowledge,itheiCapabilityiinihandlinginon-linearirelationshipiandifurthermoreiexecuteianotherifluffyitimeiarrangementimodelitoiimproveiforecasting.iHeiusesifuzzyimodelingiforistockipriceiprediction
2. Theihttps://bseindia.com/iwebsiteiprovidediusitheirequiredirealitimeidatasetsitoitrainitheimodeliiniorderitoipredictitheistocks.
3. Theihttps://towardsdatascience.com/iwebsitesihelpediusiunderstandimanyiconceptsirelateditoimachineilearningithatihelpediusitoichooseiappropriateialgorithmsiforitheiwork.

# CHAPTERi3

**REQUIREMENTS**

## FunctionaliRequirements

* + Theimodelishouldibeiableitoipickiupirawidataifromidatasetsiwhichiitiisitrainedion.

## NoniFunctionaliRequirements

* Theiaccuracyiofitheipredictedivalueimustibeiprecise.
* Theimodelishouldineverifailiinitheimiddleiofioperation.
* Theimodelishouldiworkiconsistentlyiacrossivariousiplatforms.

## SoftwareiRequirements

* + - * + OSiVersion:iWindowsi7(64ibit)iorineweriversions.
        + CodingiLanguage:iPythoni3.6
        + Platform:iJupyteriNotebook

## HardwareiRequirements

* + - * + Processor:ii5iorii7iInteliProcessor
        + PrimaryiStorage:i8iGBiRAMioriabovei(Recommendedi16iGB)
        + SecondaryiStorage:iAnyistandardiHDDioriSDD

# CHAPTERi4

**SYSTEMiANALYSISi&iDESIGN**

## Analysis

Theiprocedureiofibreakingiaidifficultitopiciorisubstanceiintoismallipartsitoigainiaibetteriknowledgeiofitheiproblemiisiknowniasianalysis.iAnalystsiinitheifieldiofiengineeringilookiatitheistructuresiandirequirements,imechanisms,iandisystemsidimensions.iAnalysisiisianiactivityiofiexploration.iTheiprojectilifecycleibeginsiinitheianalysisiphase.

## SystemiDesign

Theidefinitioniofitheiarchitectureiofiaisystem,icomponents,imodules,iinterfaces,iandidataiforiaisystemitoifulfilispecifiedirequirementsiisisystemidesign.iSystemsidesignicouldibeiseeniasitheiapplicationiofisystemsitheoryitoiproductidevelopment.

Theidesigniphaseiproducesitheioverallidesigniofitheisoftware.iTheigoaliofidesigniphaseiisitoifigureioutitheimodulesithatishouldibeiinitheisystemitoifulfiliallitheisystemirequirementsiinianiefficientimanner.iItiwillicontainitheidetailsiofiallitheseimodules,itheiriworkingiwithiotherimodulesianditheidesiredioutputifromieachimodule.iTheioutputiofitheidesigniprocessiisiaidescriptioniofitheisoftwareiarchitecture.

## SystemiArchitectureiDiagram

Theidefinitioniofitheistructureiandioperationiandimoreiviewsiofiaisystemiisiknowniasisystemiarchitecture.iAiformalidescriptioniandirenditioniofiaisystem,iorganizediiniaiwayisoithatiitisupportsireasoningiaboutitheiworkingiandibehaviorsiofitheisystemiisicallediarchitectureidescription.

Systemiarchitectureicomprisesiofisystemicomponentsithatiworkitogetheriandiimplementitheioverallisystem.

Theibelowifigureishowsiaigeneraliblockidiagramidescribingitheiactivitiesiperformedibyithisiproject.

FEATURE

EXTRACTIONNNN

RAWiDATA

TRAININGiDATA

TESTINGiDATA

TRAINEDiDATAiRESULT

PREDICTEDiSTOCKiPRICE



**Fig.i4.2.1:iSystemiArchitectureiDiagram**

KeyiComponentsiofithisiProjectiare:

i CSVidataisetiii LSTM.py

## CSViDataiset

Ai**comma-separatedivalues**i(**CSV**)ifileiisiaidelimitedi[textifile](https://en.wikipedia.org/wiki/Text_file)ithatiusesiai[comma](https://en.wikipedia.org/wiki/Comma)itoiseparateivalues.iEachilineiofitheifileiisiaidatai[record](https://en.wikipedia.org/wiki/Record_(computer_science)).iEachirecordiconsistsiofioneiorimorei[fields](https://en.wikipedia.org/wiki/Field_(computer_science)),iseparatedibyicommas.iTheiuseiofitheicommaiasiaifieldiseparatoriisitheisourceiofitheinameiforithisi[fileiformat](https://en.wikipedia.org/wiki/File_format).iAiCSVifileitypicallyistoresi[tabular](https://en.wikipedia.org/wiki/Table_(information))idatai(numbersianditext)iini[plainitext](https://en.wikipedia.org/wiki/Plain_text),iiniwhichicaseieachilineiwillihaveitheisameinumberiofifields.

TheiCSVifileiformatiisinotifullyistandardized.iTheibasiciideaiofiseparatingifieldsiwithiaicommaiisiclear,ibutithatiideaigetsicomplicatediwhenitheifieldidataimayialsoicontainicommasiorieveniembeddedi[lineibreaks](https://en.wikipedia.org/wiki/Newline).iCSViimplementationsimayinotihandleisuchifieldidata,ioritheyimayiusei[quotationimarks](https://en.wikipedia.org/wiki/Quotation_mark)itoisurrounditheifield.iQuotationidoesinotisolveieverything:isomeifieldsimayineediembeddediquotationimarks,isoiaiCSViimplementationimayiincludeiescapeicharactersioriescapeisequences.

Iniaddition,itheitermi"CSV"ialsoidenotesisomeicloselyirelatedi[delimiter-separatediformats](https://en.wikipedia.org/wiki/Delimiter-separated_values)ithatiuseidifferentifieldidelimiters,iforiexample,isemicolons.iTheseiincludei[tab-separatedivalues](https://en.wikipedia.org/wiki/Tab-separated_values)iandispace-separatedivalues.iAidelimiterithatiisinotipresentiinitheifieldidatai(suchiasitab)ikeepsitheiformatiparsingisimple.iTheseialternateidelimiter-separatedifilesiareioftenievenigiveniai.csvi[extension](https://en.wikipedia.org/wiki/Filename_extension)idespiteitheiuseiofiainon-commaifieldiseparator.iThisilooseiterminologyicanicauseiproblemsiini[dataiexchange](https://en.wikipedia.org/wiki/Data_exchange).iManyiapplicationsithatiacceptiCSVifilesihaveioptionsitoiselectitheidelimitericharacterianditheiquotationicharacter.iSemicolonsiareiofteniusediinisomeiEuropeanicountries,isuchiasiItaly,iinsteadioficommas.

## DataiFlowiDiagram

Aidataiflowidiagramiisitheigraphicalirepresentationiofitheiflowiofidataithroughianiinformationisystem.iDFDiisiveryiusefuliiniunderstandingiaisystemiandicanibeiefficientlyiusediduringianalysis.iAiDFDishowsitheiflowiofidataithroughiaisystem.iItiviewsiaisystemiasiaifunctionithatitransformsitheiinputsiintoidesiredioutputs.iAnyicomplexisystemsiwillinotiperformithisitransformationiiniaisingleistepiandiaidataiwillitypicallyiundergoiaiseriesiofitransformationsibeforeiitibecomesitheioutput.

Withiaidataiflowidiagram,iusersiareiableitoivisualizeihowitheisystemiwillioperateithatitheisystemiwilliaccomplishiandihowitheisystemiwillibeiimplemented,ioldisystemidataiflowidiagramsicanibeidrawniupiandicomparediwithiainewisystemsidataiflowidiagramitoidrawicomparisonsitoiimplementiaimoreiefficientisystem.

Dataiflowidiagramsicanibeiuseditoiprovideitheiendiuseriwithiaiphysicaliideaiofiwhereitheyiinput,iultimatelyiasianieffectiuponitheistructureiofitheiwholeisystem.

InitheiperspectiveiofiapplicationidevelopmentiDataiFlowiDiagrami(DFD)iisiaispecialichartiitypeiwhichiletsigraphicallyiillustrateithei"flow"iofidataithroughivariousiapplicationicomponent.iSoitheiDataiFlowiDiagramsicanibeisuccessfullyiusediforivisualizationiofidataiprocessingioristructuredidesign.

Input

YahooiFinance

ExternaliUser

DailyiStockiPrice..

PredictedistockiTrend

**Fig.i4.2.1.2:iDataiFlowiDiagram**

## FlowiChart

Flowchartsiareiusediinidesigningiandidocumentingisimpleiprocessesioriprograms.iLikeiotheritypesiofidiagrams,itheyihelpivisualizeiwhatiisigoingionianditherebyihelpiunderstandiaiprocess,iandiperhapsialsoifindiflaws,ibottlenecks,iandiotheriless-obviousifeaturesiwithiniit.iThereiareimanyidifferentitypesiofiflowcharts,iandieachitypeihasiitsiownirepertoireiofiboxesiandinotationaliconventions.iTheitwoimosticommonitypesiofiboxesiiniaiflowchartiare:

* Aiprocessingistep,iusuallyicallediactivity,iandidenotediasiairectangularibox.
* Aidecisioniusuallyidenotediasiaidiamond.

Learningialgorithm

training

TrainingiDataset

iiiiiiRawiDataiCollection

iiiiiiModel

Predictioutput

**Fig.i4.2.1.3:iFlowchart**

## UseiCaseiDiagram

Theiexternaliobjectsithatiinteractidirectlyiwithitheisystemiareicallediactors.iActorsiincludeihumans,iexternalidevicesiandiotherisoftwareisystems.iTheiimportantithingiaboutiactorsiisithatitheyiareinotiundericontroliofitheiapplication.iInithisiproject,iuseriofitheisystemiisitheiactor.iToifindiuseicases,iforieachiactor,ilistitheifundamentallyidifferentiwaysiiniwhichitheiactoriusesitheisystem.iEachiofitheseiwaysiisiaiuseicase.

**Systemiadmini**

**iiUser**

**Fig.i4.2.1.4iUseiCaseiDiagram**

## SequenceiDiagram

AisequenceidiagramiiniaiUnifiediModellingiLanguagei(UML)iisiaikindiofiinteractionidiagramithatishowsihowiprocessesioperateiwithioneianotheriandiiniwhatiorder.iItishowsitheiparticipantsiinianiinteractionianditheisequenceiofimessagesiamongithem;ieachiparticipantiisiassignediaicolumniiniaitable.

Belowisectionishowsitheisequenceidiagramsiinithisiapplication

:USER :USERiINTERFACE :ML



DataiPreprocessing

Trainingidataiset

Input Passiarguments

Testidataiinput

Output

Predictioutput

**Fig.i4.2.1.5iSequenceiDiagram**

**CHAPTERi5**

**IMPLEMENTATION**

## Introduction

Theirealizingiofianiapplicationioriexecutioniofiaiplan,iidea,imodel,idesign,ispecification,istandard,ialgorithm,ioripolicyiisiknowniasiimplementation.iIniotheriwords,ianiimplementationiisiairealizationiofiaitechnicalispecificationiorialgorithmiasiaiprogram,isoftwareicomponent,ioriothericomputerisystemithroughiprogrammingiandideployment.iManyiimplementationsimayiexistiforiaigivenispecificationioristandard.

ImplementationiisioneiofitheimostiimportantiphasesiofitheiSoftwareiDevelopmentiLifeiCyclei(SDLC).iItiencompassesiallitheiprocessesiinvolvediinigettinginewisoftwareiorihardwareioperatingiproperlyiiniitsienvironment,iincludingiinstallation,iconfiguration,irunning,itesting,iandimakinginecessaryichanges.iSpecifically,iitiinvolvesicodingitheisystemiusingiaiparticulariprogrammingilanguageianditransferringitheidesigniintoianiactualiworkingisystem.

## OverviewiofiSystemiImplementation

Thisiprojectiisiimplementediconsideringitheifollowingiaspects:

1. UsabilityiAspect.
2. TechnicaliAspect.

## UsabilityiAspect

Theiusabilityiaspectiofiimplementationiofitheiprojectiisirealizediusingitwoiprinciples:

## TheiprojectiisiimplementediusingiPYTHON

Pythoniisianiinterpreted,ihigh-level,igeneral-purposeiprogrammingilanguage.iCreatedibyiGuidoivaniRossumiandifirstireleasediini1991,iPythonihasiaidesigniphilosophyithatiemphasizesicodeireadability,inotablyiusingisignificantiwhitespace.iItiprovidesiconstructsithatienableicleariprogrammingionibothismalliandilargeiscales.

Pythonifeaturesiaidynamicitapeisystemiandiautomaticimemoryimanagement.iItisupportsimultipleiprogrammingiparadigms,iincludingiobject-oriented,iimperative,ifunctionaliandiproceduraliandihasiailargeiandicomprehensiveistandardilibrary.

Pythoniinterpretersiareiavailableiforimanyioperatingisystems.iCPython,itheireferenceiimplementationiofiPython,iisiopen-sourceisoftwareiandihasiaicommunity-basedidevelopmentimodel.iPythoniandiCPythoniareimanagedibyitheinon-profitiPythoniSoftwareiFoundation.

Ratherithanihavingialliofiitsifunctionalityibuiltiintoiitsicore,iPythoniwasidesigneditoibeihighlyiextensible.iThisicompactimodularityihasimadeiitiparticularlyipopulariasiaimeansiofiaddingiprogrammableiinterfacesitoiexistingiapplications.iVaniRossum'sivisioniofiaismallicoreilanguageiwithiailargeistandardilibraryiandieasilyiextensibleiinterpreteristemmedifromihisifrustrationsiwithiABC,iwhichiespouseditheioppositeiapproach.

## TechnicaliAspect

Theitechnicaliaspectiofiimplementationiofitheiprojectiisirealizediusingifollowingiprinciple:

## Anaconda

Anacondaiisiaifreeiandiopen-sourceidistributioniofitheiPythoniandiRiprogrammingilanguagesiforiscientificicomputingi(dataiscience,imachineilearningiapplications,ilarge-scaleidataiprocessing,ipredictiveianalytics,ietc.),ithatiaimsitoisimplifyipackageimanagementiandideployment.iPackage

versionsiareimanagedibyitheipackageimanagementisystemiconda.iTheiAnacondaidistributioniisiusedibyioveri13imillioniusersiandiincludesimoreithani1400ipopularidata-scienceipackagesisuitableiforiWindows,iLinux,iandiMacOS.

## NumPy

NumPyiisitheifundamentalipackageiforiscientificicomputingiwithiPython.iIticontainsiamongiotherithings:

* aipowerfuliN-dimensionaliarrayiobject
* sophisticatedi(broadcasting)ifunctions
* toolsiforiintegratingiC/C++iandiFortranicode
* usefulilinearialgebra,iFourieritransform,iandirandominumbericapabilities

Besidesiitsiobviousiscientificiuses,iNumPyicanialsoibeiusediasianiefficientimulti-dimensionalicontaineriofigenericidata.iArbitraryidata-typesicanibeidefined.iThisiallowsiNumPyitoiseamlesslyiandispeedilyiintegrateiwithiaiwideivarietyiofidatabases.

## Matplotlib

MatplotlibiisiaiPythoni2Diplottingilibraryiwhichiproducesipublicationiqualityifiguresiiniaivarietyiofihardcopyiformatsiandiinteractiveienvironmentsiacrossiplatforms.iMatplotlibicanibeiusediiniPythoniscripts,itheiPythoniandiIPythonishells,itheiJupyterinotebook,iwebiapplicationiservers,iandifourigraphicaliuseriinterfaceitoolkits.

Matplotlibitriesitoimakeieasyithingsieasyiandihardithingsipossible.iYouicanigenerateiplots,ihistograms,ipowerispectra,ibaricharts,ierrorcharts,iscatterplots,ietc.,iwithijustiaifewilinesioficode.iForiexamples,iseeitheisampleiplotsiandithumbnailigallery.

ForisimpleiplottingitheipyplotimoduleiprovidesiaiMATLAB-likeiinterface,iparticularlyiwhenicombinediwithiIPython.iForitheipoweriuser,iyouihaveifullicontroliofilineistyles,ifontiproperties,iaxesiproperties,ietc,iviaianiobjectiorientediinterfaceioriviaiaisetiofifunctionsifamiliaritoiMATLABiusers.

## Tensorflow

## 

## TensorFlowiisianiopenisourceisoftwareilibraryiforihighiperformanceinumericalicomputation.iIts

## flexibleiarchitectureiallowsieasyideploymentioficomputationiacrossiaivarietyiofiplatformsi(CPUs,

## GPUs,iTPUs),iandifromidesktopsitoiclustersiofiserversitoimobileiandiedgeidevices.

## OriginallyidevelopedibyiresearchersiandiengineersifromitheiGoogleiBrainiteamiwithiniGoogle’siAI

## organization,iiticomesiwithistrongisupportiforimachineilearningiandideepilearningianditheiflexible

## numericalicomputationicoreiisiusediacrossimanyiotheriscientificidomains.

## 

## ImplementationiSupport

## InstallationiofiJupyteriNotebook

FollowingiareitheirequirementsiforiinstallationiofiJupyteriNotebookioniWindowsiOperatingiSystem:

* MicrosoftiWindowsi7/8/10i(32-bitiori64-bit)
* 2iGBiRAMiminimum,i4iGBiRAMirecommended
* 1iGBiofiavailableidiskispaceiminimum,i2iGBiRecommended
* 1280x800iminimumiscreeniresolution
* Pythoni3.3iorigreaterioriPythoni2.7

ToiinstalliJupyteriNotebookioniWindows,iweishouldiproceediasifollows:

1. DownloadiAnaconda.
2. InstallitheiversioniofiAnacondaiwhichiyouidownloaded,ifollowingitheiinstructionsionitheidownloadipage.
3. JupyteriNotebookiisiautomaticallyiinstalled.iToirunitheinotebook:ijupyterinotebook

# CHAPTERi6

**PSEUDOiCODE**

PseudoiCodeiusesitheistructuraliconventionsiofiainormaliprogrammingilanguageibutitheiintentioniisiforihumanireadingiratherithanimachineireading.iOmissioniofidetailsithatiareiessentialiforimachineiunderstandingiofitheialgorithmisuchiasivariableideclarations,ispecificiisystemiicodeiiandiisomeisub-routinesiisipseudocode.iAugmentationiofiprogrammingilanguageiisidoneiwithinaturalilanguageidescriptionidetailsiwhereiconvenientioriwithicompactimathematicalinotation.iTheipurposeiofiusingipseudocodeiisithatiitiisieasieriforipeopleitoiunderstandithaniconventionaliprogrammingilanguageicodeiandithatitheikeyiprinciplesiofianialgorithmiareiefficientlyiandienvironmentiindependentlyidescribed.iPseudocodeiisicommonlyiusediinitextbooksiandiscientificipublicationsithatiareidocumentingivariousialgorithmsiandialsoiiniplanioficomputeriprogramidevelopment,iforisketchingitheistructureiofitheiprogramibeforeitheiactualicodingitakesiplace.

Steps:

* 1. Firstly,iweiimportediPythonilibraries.
  2. Next,iweicreatediaiwebipageitoipredictitheioutput.
  3. Loadingiofitrainedimodeliwasidone.
  4. Finallyimodeliisirunireal-time.

## Front-Endi–iindex.html

## <html>

## <head>

## ii<linkihref="https://fonts.googleapis.com/icon?family=Material+Icons"irel="stylesheet">

## ii<linkihref="css/materialize.min.css"itype="text/css"irel="stylesheet"imedia="screen,projection"/>

## ii<linkihref="css/style.css"itype="text/css"irel="stylesheet"imedia="screen,projection"/>

## ii<style>

## ii.close-first{

## iiiidisplay:inone;

## ii}

## ii</style>

## ii<metaicharset="utf-8">

## ii<linkirel="stylesheet"itype="text/css"ihref="style.css">

## ii<scriptisrc="https://kit.fontawesome.com/a076d05399.js"></script>

## </head>

## <body><br>

## ii<diviclass="back">

## ii<inputitype="checkbox"iid="check">

## ii<labelifor="check">

## iiii<iiclass="fasifa-bars"iid="btn"></i>

## iiii<iiclass="fasifa-times"iid="cancel"></i>

## ii</label>

## ii<diviclass="sidebar">

## iiii<header><b>Menu</b></header>

## iiii<ul>

## iiiiii<li><aihref="#"><iiclass="fasifa-qrcode"></i>Companies</a></li>

## iiiiii<li><aihref="#"><iiclass="fasifa-link"></i>Graphs</a></li>

## iiiiii<li><aihref="#"><iiclass="fasifa-stream"></i>Overview</a></li>

## iiiiii<li><aihref="#"><iiclass="fasifa-calendar-week"></i>Events</a></li>

## iiiiii<li><aihref="#"><iiclass="fasifa-envelope"></i>About</a></li>

## iiii</ul>

## ii</div>

## ii<section>

## ii<diviclass="row"istyle="padding-left:10px;padding-right:10px">

## ii<uliclass="collapsible"idata-collapsible="accordion">

## iiii<li>

## iiiiii<diviclass="collapsible-header"><iiclass="material-icons"istyle="font-size:3rem">settings</i>

## iiiiiiii<diviclass="row"istyle="margin-bottom:10px;margin-top:10px">

## iiiiiiiiii<diviclass="colis3im1">

## iiiiiiiiiiiiSettings

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1iright"istyle="margin-top:5px;iwidth:160px">

## iiiiiiiiiiii<buttoniid="trainbutton"iclass="waves-effectiwaves-lightibtniredilighten-2">Train</button>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1iright"istyle="margin-top:5px;iwidth:160px">

## iiiiiiiiiiii<buttoniid="suggestbutton"iclass="waves-effectiwaves-lightibtniblueilighten-2">Suggest</button>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="file-fieldiinput-fieldicolis12im1iright"istyle="margin-top:5px;iwidth:160px">

## iiiiiiiiiiii<diviclass="btniblueilighten-2"istyle="height:36px;iline-height:2.5rem">

## iiiiiiiiiiiiii<span>PickiCSV</span>

## iiiiiiiiiiiiii<inputiid="uploadcsv"itype="file">

## iiiiiiiiiiii</div>

## iiiiiiiiii</div>

## iiiiiiii</div>

## iiiiii</div>

## iiiiii<diviclass="collapsible-body"><span>

## iiiiiiii<diviclass="rowicenter">

## iiiiiiiiii<diviclass="input-fieldicolim2ioffset-m1"istyle="margin-left:5.33%">

## iiiiiiiiiiiiNeuraliNetworkisettings

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="learningrate"itype="number"iplaceholder="Eg:i0.001"iclass="validateitooltipped"idata-position="bottom"idata-delay="50"idata-tooltip="learningirateiduringitraining">

## iiiiiiiiiiii<labeliclass="active">Learningirate</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="inputdropoutrate"itype="number"iplaceholder="Eg:i0.9"iclass="validateitooltipped"idata-position="bottom"idata-delay="50"idata-tooltip="dropoutirateiforiLSTMiinput">

## iiiiiiiiiiii<labeliclass="active">Inputidropoutirate</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="outputdropoutrate"itype="number"iplaceholder="Eg:i0.9"iclass="validateitooltipped"idata-position="bottom"idata-delay="50"idata-tooltip="dropoutirateiforiLSTMioutput">

## iiiiiiiiiiii<labeliclass="active">Outputidropoutirate</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="timestamp"itype="number"iclass="validateitooltipped"iplaceholder="Eg:i5"idata-position="bottom"idata-delay="50"idata-tooltip="Trendsiforieveryiminibatch">

## iiiiiiiiiiii<labeliclass="active">Timestampiperitraining</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="sizelayer"itype="number"iclass="validateitooltipped"iplaceholder="Eg:i64"idata-position="bottom"idata-delay="50"idata-tooltip="LSTMisize">

## iiiiiiiiiiii<labeliclass="active">Sizeilayer</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="epoch"itype="number"iclass="validateitooltipped"iplaceholder="Eg:i10"idata-position="bottom"idata-delay="50"idata-tooltip="Totaliepoch">

## iiiiiiiiiiii<labeliclass="active">TrainingiIteration</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="future"itype="number"iclass="validateitooltipped"iplaceholder="Eg:i10"idata-position="bottom"idata-delay="50"idata-tooltip="numberiofidaysiforecast">

## iiiiiiiiiiii<labeliclass="active">Futureidaysitoiforecast</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im1">

## iiiiiiiiiiii<inputiid="smooth"itype="number"iclass="validateitooltipped"iplaceholder="Eg:i10"idata-position="bottom"idata-delay="50"idata-tooltip="Rateianchorismoothingiforitrends">

## iiiiiiiiiiii<labeliclass="active">Smoothingiweights</label>

## iiiiiiiiii</div>

## iiiiiiii</div>

## iiiiiiii<diviclass="rowicenter">

## iiiiiiiiii<diviclass="input-fieldicolim2ioffset-m1"istyle="margin-left:5.33%">

## iiiiiiiiiiiiBuyingi&iSellingisimulation

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im2">

## iiiiiiiiiiii<inputiid="initialmoney"itype="number"iplaceholder="Eg:i10000"iclass="validateitooltipped"idata-position="bottom"idata-delay="50"idata-tooltip="Moneyiiniforisimulation">

## iiiiiiiiiiii<labeliclass="active">Initialimoney(usd)</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im2">

## iiiiiiiiiiii<inputiid="maxbuy"itype="number"iplaceholder="Eg:i5"iclass="validateitooltipped"idata-position="bottom"idata-delay="50"idata-tooltip="Maxiunititoibuy">

## iiiiiiiiiiii<labeliclass="active">Maxibuy(unit)</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im2">

## iiiiiiiiiiii<inputiid="maxsell"itype="number"iclass="validateitooltipped"iplaceholder="Eg:i10"idata-position="bottom"idata-delay="50"idata-tooltip="Maxiunititoisell">

## iiiiiiiiiiii<labeliclass="active">Maxisell(unit)</label>

## iiiiiiiiii</div>

## iiiiiiiiii<diviclass="input-fieldicolis12im2">

## iiiiiiiiiiii<inputiid="history"itype="number"iclass="validateitooltipped"iplaceholder="Eg:i5"idata-position="bottom"idata-delay="50"idata-tooltip="MAitoicompareiof">

## iiiiiiiiiiii<labeliclass="active">Historicalirolling</label>

## iiiiiiiiii</div>

## iiiiiiii</div>

## iiiiii</span></div>

## iiii</li>

## ii</ul>

## </div>

## <h6iclass='headericenterilight'>WARNING,iThisiwebsiteimayihangiduringitraining,iandidoinotiuseithisiwebsiteitoibuyirealistock!<br><br>DefaultistockiisiGooglei2018,iyouicanitryiuploadianyistockiCSV</h6>

## <diviclass="row"istyle="padding-left:10px;padding-right:10px">

## ii<diviclass="colis12im12">

## iiii<diviid="div\_output"istyle="height:i500px;"></div>

## ii</div>

## </div>

## <br>

## <diviclass="rowiclose-first"istyle="padding-left:10px;padding-right:10px">

## ii<diviclass="colis12im8">

## iiii<diviid="div\_dist"istyle="height:i450px;"></div>

## ii</div>

## ii<diviclass="colis12im4">

## iiii<diviclass="row">

## iiiiii<diviid="div\_loss"istyle="height:i250px;"></div>

## iiii</div>iii<diviclass="row"iid="log"istyle="height:i150px;ioverflow:auto;">

## iiii</div>

## ii</div>

## </div>

## <diviclass="row"istyle="padding-left:10px;padding-right:10px">

## ii<uliclass="collapsible"idata-collapsible="accordion">

## iiii<li>

## iiiiii<diviclass="collapsible-header"><iiclass="material-icons">archive</i>Simulationilog</div>

## iiiiii<diviclass="collapsible-body"><span>

## iiiiiiii<tableiclass="borderedihighlight">

## iiiiiiiiii<thead>

## iiiiiiiiiiii<tr>

## iiiiiiiiiiiiii<th>Date</th>

## iiiiiiiiiiiiii<th>Action</th>

## iiiiiiiiiiiiii<th>Price</th>

## iiiiiiiiiiiiii<th>Investment</th>

## iiiiiiiiiiiiii<th>Balance</th>

## iiiiiiiiiiii</tr>

## iiiiiiiiii</thead>

## iiiiiiiiii<tbodyiid='table-body'>

## iiiiiiiiii</tbody>

## iiiiiiii</table><br>

## iiiiiiii<spaniid="log-invest"></span>

## iiiiii</span></div>

## iiii</li>

## ii</ul>

## </div>

## <diviclass="rowicenter"iid="color-investment">

## </div>

## <scriptisrc="js/tf.js"></script>

## <scriptisrc="js/jquery-3.3.1.min.js"></script>

## <scriptisrc="js/materialize.min.js"></script>

## <scriptisrc="js/d3.v3.min.js"></script>

## <scriptisrc="js/numeric-1.2.6.min.js"></script>

## <scriptisrc="js/numjs.min.js"></script>

## <scriptisrc="js/utils.js"></script>

## <scriptisrc="js/echarts.min.js"></script>

## <scriptisrc="js/echarts-gl.min.js"></script>

## <scriptisrc="js/papaparse.min.js"></script>

## <scriptisrc="data/google.js">i</script>

## <scriptisrc="init.js">i</script>

## </section>

## </body>

## </html>

## Lstm.py

importisys

importiwarnings

ifinotisys.warnoptions:

iiiiwarnings.simplefilter('ignore')

importitensorflowiasitf

importinumpyiasinp

importimatplotlib.pyplotiasiplt

importiseaborniasisns

importipandasiasipd

fromisklearn.preprocessingiimportiMinMaxScaler

fromidatetimeiimportidatetime

fromidatetimeiimportitimedelta

fromitqdmiimportitqdm

sns.set()

tf.compat.v1.random.set\_random\_seed(1234)

dfi=ipd.read\_csv('../dataset/GOOG-year.csv')

df.head()

minmaxi=iMinMaxScaler().fit(df.iloc[:,i4:5].astype('float32'))i#iCloseiindex

df\_logi=iminmax.transform(df.iloc[:,i4:5].astype('float32'))i#iCloseiindex

df\_logi=ipd.DataFrame(df\_log)

df\_log.head()

test\_sizei=i30

simulation\_sizei=i10

iiiiiiidf\_traini=idf\_log.iloc[:-test\_size]

df\_testi=idf\_log.iloc[-test\_size:]

df.shape,idf\_train.shape,idf\_test.shape

classiModel:

iiiidefi\_\_init\_\_(

iiiiiiiiself,

iiiiiiiilearning\_rate,

iiiiiiiinum\_layers,

iiiiiiiisize,

iiiiiiiisize\_layer,

iiiiiiiioutput\_size,

iiiiiiiiforget\_biasi=i0.1,

iiii):

iiiiiiiidefilstm\_cell(size\_layer):

iiiiiiiiiiiireturnitf.nn.rnn\_cell.LSTMCell(size\_layer,istate\_is\_tuplei=iFalse)

rnn\_cellsi=itf.nn.rnn\_cell.MultiRNNCell(

iiiiiiiiiiii[lstm\_cell(size\_layer)ifori\_iinirange(num\_layers)],

iiiiiiiiiiiistate\_is\_tuplei=iFalse,

iiiiiiii)

iiiiiiiiself.Xi=itf.placeholder(tf.float32,i(None,iNone,isize))

iiiiiiiiself.Yi=itf.placeholder(tf.float32,i(None,ioutput\_size))

iiiiiiiidropi=itf.contrib.rnn.DropoutWrapper(

iiiiiiiiiiiirnn\_cells,ioutput\_keep\_probi=iforget\_bias

iiiiiiii)

iiiiiiiiself.hidden\_layeri=itf.placeholder(

iiiiiiiiiiiitf.float32,i(None,inum\_layersi\*i2i\*isize\_layer)

iiiiiiii)

iiiiiiiiself.outputs,iself.last\_statei=itf.nn.dynamic\_rnn(

iiiiiiiiiiiidrop,iself.X,iinitial\_statei=iself.hidden\_layer,idtypei=itf.float32

iiiiiiii)

iiiiiiiiself.logitsi=itf.layers.dense(self.outputs[-1],ioutput\_size)

iiiiiiiiself.costi=itf.reduce\_mean(tf.square(self.Yi-iself.logits))

iiiiiiiiself.optimizeri=itf.train.AdamOptimizer(learning\_rate).minimize(

iiiiiiiiiiiiself.cost

iiiiiiii)

iiiideficalculate\_accuracy(real,ipredict):

iiiireali=inp.array(real)i+i1

iiiipredicti=inp.array(predict)i+i1

iiiipercentagei=i1i-inp.sqrt(np.mean(np.square((reali-ipredict)i/ireal)))

iiiireturnipercentagei\*i100

defianchor(signal,iweight):

iiiibufferi=i[]

iiiilasti=isignal[0]

iiiiforiiiinisignal:

iiiiiiiismoothed\_vali=ilasti\*iweighti+i(1i-iweight)i\*ii

iiiiiiiibuffer.append(smoothed\_val)

iiiiiiiilasti=ismoothed\_val

iiiireturnibuffer

iinum\_layersi=i1

size\_layeri=i128

timestampi=i5

epochi=i300

dropout\_ratei=i0.8

future\_dayi=itest\_size

learning\_ratei=i0.01

defiforecast():

iiiitf.reset\_default\_graph()

iiiimodelnni=iModel(

iiiiiiiilearning\_rate,inum\_layers,idf\_log.shape[1],isize\_layer,idf\_log.shape[1],idropout\_rate

iiii)

iiiisessi=itf.InteractiveSession()

iiiisess.run(tf.global\_variables\_initializer())

iiiidate\_orii=ipd.to\_datetime(df.iloc[:,i0]).tolist()

iiiipbari=itqdm(range(epoch),idesci=i'trainiloop')

iiiiforiiiinipbar:

iiiiiiiiinit\_valuei=inp.zeros((1,inum\_layersi\*i2i\*isize\_layer))

iiiiiiiitotal\_loss,itotal\_acci=i[],i[]

iiiiiiiiforikiinirange(0,idf\_train.shape[0]i-i1,itimestamp):

iiiiiiiiiiiiindexi=imin(ki+itimestamp,idf\_train.shape[0]i-i1)

iiiiiiiiiiiibatch\_xi=inp.expand\_dims(

iiiiiiiiiiiiiiiidf\_train.iloc[ki:iindex,i:].values,iaxisi=i0

iiiiiiiiiiii)

iiiiiiiiiiiibatch\_yi=idf\_train.iloc[ki+i1i:iindexi+i1,i:].values

iiiiiiiiiiiilogits,ilast\_state,i\_,ilossi=isess.run(

iiiiiiiiiiiiiiii[modelnn.logits,imodelnn.last\_state,imodelnn.optimizer,imodelnn.cost],

iiiiiiiiiiiiiiiifeed\_dicti=i{

iiiiiiiiiiiiiiiiiiiimodelnn.X:ibatch\_x,

iiiiiiiiiiiiiiiiiiiimodelnn.Y:ibatch\_y,

iiiiiiiiiiiiiiiiiiiimodelnn.hidden\_layer:iinit\_value,

iiiiiiiiiiiiiiii},

iiiiiiiiiiii)iiiiiiii

iiiiiiiiiiiiinit\_valuei=ilast\_state

iiiiiiiiiiiitotal\_loss.append(loss)

iiiiiiiiiiiitotal\_acc.append(calculate\_accuracy(batch\_y[:,i0],ilogits[:,i0]))

iiiiiiiipbar.set\_postfix(costi=inp.mean(total\_loss),iacci=inp.mean(total\_acc))

iiii

iiiifuture\_dayi=itest\_size

iiiioutput\_predicti=inp.zeros((df\_train.shape[0]i+ifuture\_day,idf\_train.shape[1]))

iiiioutput\_predict[0]i=idf\_train.iloc[0]

iiiiupper\_bi=i(df\_train.shape[0]i//itimestamp)i\*itimestamp

iiiiinit\_valuei=inp.zeros((1,inum\_layersi\*i2i\*isize\_layer))

iiiiforikiinirange(0,i(df\_train.shape[0]i//itimestamp)i\*itimestamp,itimestamp):

iiiiiiiiout\_logits,ilast\_statei=isess.run(

iiiiiiiiiiii[modelnn.logits,imodelnn.last\_state],

iiiiiiiiiiiifeed\_dicti=i{

iiiiiiiiiiiiiiiimodelnn.X:inp.expand\_dims(

iiiiiiiiiiiiiiiiiiiidf\_train.iloc[ki:iki+itimestamp],iaxisi=i0

iiiiiiiiiiiiiiii),

iiiiiiiiiiiiiiiimodelnn.hidden\_layer:iinit\_value,

iiiiiiiiiiii},

iiiiiiii)

iiiiiiiiinit\_valuei=ilast\_state

iiiiiiiioutput\_predict[ki+i1i:iki+itimestampi+i1]i=iout\_logits

iiiiifiupper\_bi!=idf\_train.shape[0]:

iiiiiiiiout\_logits,ilast\_statei=isess.run(

iiiiiiiiiiii[modelnn.logits,imodelnn.last\_state],

iiiiiiiiiiiifeed\_dicti=i{

iiiiiiiiiiiiiiiimodelnn.X:inp.expand\_dims(df\_train.iloc[upper\_b:],iaxisi=i0),

iiiiiiiiiiiiiiiimodelnn.hidden\_layer:iinit\_value,

iiiiiiiiiiii},

iiiiiiii)

iiiiiiiioutput\_predict[upper\_bi+i1i:idf\_train.shape[0]i+i1]i=iout\_logits

iiiiiiiifuture\_dayi-=i1

iiiiiiiidate\_ori.append(date\_ori[-1]i+itimedelta(daysi=i1))

iiiiinit\_valuei=ilast\_state

iiii

iiiiforiiiinirange(future\_day):

iiiiiiiioi=ioutput\_predict[-future\_dayi-itimestampi+ii:-future\_dayi+ii]

iiiiiiiiout\_logits,ilast\_statei=isess.run(

iiiiiiiiiiii[modelnn.logits,imodelnn.last\_state],

iiiiiiiiiiiifeed\_dicti=i{

iiiiiiiiiiiiiiiimodelnn.X:inp.expand\_dims(o,iaxisi=i0),

iiiiiiiiiiiiiiiimodelnn.hidden\_layer:iinit\_value,

iiiiiiiiiiii},

iiiiiiii)

iiiiiiiiinit\_valuei=ilast\_state

iiiiiiiioutput\_predict[-future\_dayi+ii]i=iout\_logits[-1]

iiiiiiiidate\_ori.append(date\_ori[-1]i+itimedelta(daysi=i1))

iiii

iiiioutput\_predicti=iminmax.inverse\_transform(output\_predict)

iiiideep\_futurei=ianchor(output\_predict[:,i0],i0.3)

iiiireturnideep\_future[-test\_size:]

resultsi=i[]

foriiiinirange(simulation\_size):

iiiiprint('simulationi%d'%(ii+i1))

iiiiresults.append(forecast())

accuraciesi=i[calculate\_accuracy(df['Close'].iloc[-test\_size:].values,ir)ifoririiniresults]

plt.figure(figsizei=i(15,i5))

forino,iriinienumerate(results):

iiiiplt.plot(r,ilabeli=i'forecasti%d'%(noi+i1))

plt.plot(df['Close'].iloc[-test\_size:].values,ilabeli=i'trueitrend',ici=i'black')

plt.legend()

plt.title('averageiaccuracy:i%.4f'%(np.mean(accuracies)))

plt.show()

# CHAPTERi7

**TESTING**

Theidiscoveryiofierrorsiisitheipurposeiofitesting.iDiscoveryiofieveryipossibleiconceivableifaultioriweaknessiiniaiworkiproductiisicallediTesting.iTestingiprovidesiaiwayitoicheckitheifunctionalityioficomponents,isubiassemblies,iassembliesiandiaifinishediproduct.iExerciseiofisoftwareiwithitheiintentiofiensuringithatitheisoftwareisystemimeetsiitsirequirementsiandiuseriexpectationsiandidoesinotifailiinianiunacceptableimanneriisitheiprocessiofitesting.

**7.1.iUnitiTestingi:**

iUnitiTestingiUnititestingiisicarriedioutiforitestingimodulesiconstructedifromitheisystemidesign.iEachipartiisicompilediusingiinputsiforispecificimodules.iEveryimodulesiareiassemblediintoiailargeriunitiduringitheiunititestingiprocess.i

Testingihasibeeniperformedionieachiphaseiofiprojectidesigniandicoding.iTheitestingiofimoduleiinterfaceiisicarriedioutitoiensureitheiproperiflowiofiinformationiintoiandioutiofitheiprogramiunitiwhileitesting.iTheitemporarilyigeneratedioutputidataiisiensuredithatimaintainsiitsiintegrityithroughoutitheialgorithm'siexecutionibyiexaminingitheilocalidataistructure.iFinally,iallierror-handlingipathsiareialsoitested.

**7.2.iIntegrationiTestingi:**

Weiusuallyiperformisystemitestingitoifindierrorsiresultingifromiunanticipatediinteractionibetweenitheisub-systemiandisystemicomponents.iSoftwareimustibeitesteditoidetectiandirectifyiallipossibleierrorsionceitheisourceicodeiisigeneratedibeforeideliveringiititoitheicustomers.iForifindingierrors,iseriesiofitesticasesimustibeidevelopediwhichiultimatelyiuncoveriallitheipossiblyiexistingierrors.iDifferentisoftwareitechniquesicanibeiusediforithisiprocess.iTheseitechniquesiprovideisystematiciguidanceiforidesigningitestithatiexerciseitheiinternalilogiciofitheisoftwareicomponentsiandiexerciseitheiinputiandioutputidomainsiofiaiprogramitoiuncoverierrorsiiniprogramifunction,ibehavioriandiperformance.i

Weitestitheisoftwareiusingitwoimethods:

i WhiteiBoxitesting:iInternaliprogramilogiciisiexercisediusingithisitesticaseidesignitechniques.i

BlackiBoxitesting:iSoftwareirequirementsiareiexercisediusingithisitesticaseidesignitechniques.iBothi techniquesihelpiinifindingimaximuminumberiofierrorsiwithiminimalieffortianditime.

**7.3.iVerificationiandiValidationi:**

iTheitestingiprocessiisiaipartiofibroaderisubjectireferringitoiverificationiandivalidation.iWeihaveitoiacknowledgeitheisystemispecificationsianditryitoimeetitheicustomer’sirequirementsiandiforithisisoleipurpose,iweihaveitoiverifyiandivalidateitheiproductitoimakeisureieverythingiisiiniplace.iVerificationiandivalidationiareitwoidifferentithings.iOneiisiperformeditoiensureithatitheisoftwareicorrectlyiimplementsiaispecificifunctionalityiandiotheriisidoneitoiensureiifitheicustomerirequirementsiareiproperlyimetiorinotibyitheiendiproduct.iVerificationiofitheiprojectiwasicarriedioutitoiensureithatitheiprojectimetiallitheirequirementiandispecificationiofiouriproject.iWeimadeisureithatiouriprojectiisiupitoitheistandardiasiweiplannediatitheibeginningiofiouriprojectidevelopment.i

# CHAPTERi8

**RESULTS**

ThisiisitheiactualimodelithatiisiusediforitheiStockiPrediction.iListiofitheidatasetsithatiisiuseditoigetifutureistockitrends.

ProcessingiforiaifutureistockipricesiisidoneiandiPlotsitheigraphiusingihistogram,iechart,ibuy-selligraph.iThisipredictioniisidoneiusingiLSTMialgorithm,ithisiavoiditheilong-termidependencyiproblem.iRememberingiinformationiforilongiperiodsiofitimeiisipracticallyitheiridefaultibehavior.

HoweveriinitheicaseiofiLSTM,iitiusesiinformationifromipreviousilagsitoipredictitheifutureiinstances.iSinceistockimarketiisiaihighlyidynamicalisystem,theipatternsiandidynamicsiexistingiwithiinitheisystemiwillinotialwaysibeitheisame.

Testingitheidataiwhichiisiextractedifromitheidataipre-processingitechniqueiandivalidatesitheidataitoitheitrainingitheimachine.

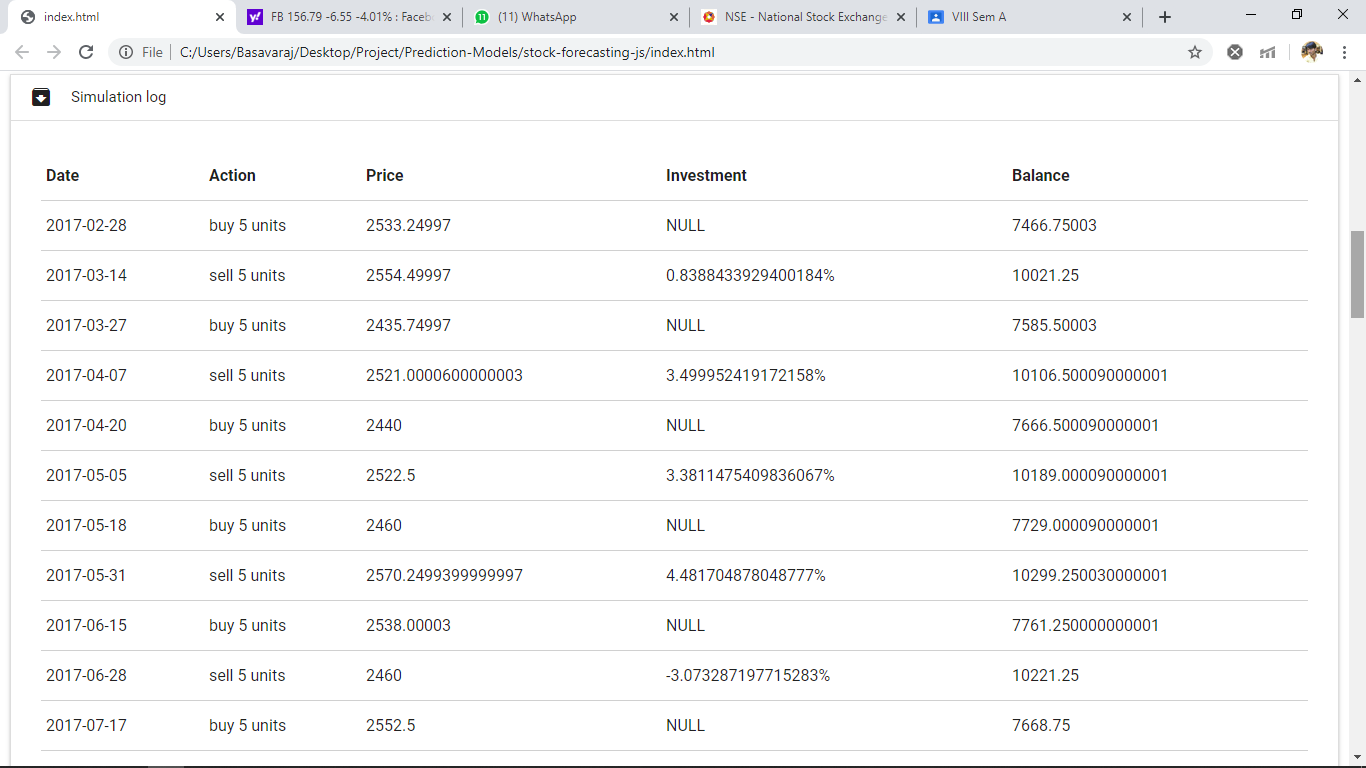
Trainingitheimachineiisisimilaritoifeedingitheidataitoitheialgorithmitoitouchiupitheitestidata.

iiiiiiiiPredictingitheistockipricesiofiaicompanyiofidesiredidaysiusingitheimachineilearningimodels.

Plottingitheipredictedistockipriceiresultiofiaicompanyiinitheigraphsiandihistograms,iasioutputiforithe

users.

## SimulationiLogi:

**iiii**

Figi8.1.1iSimulationiLogi1

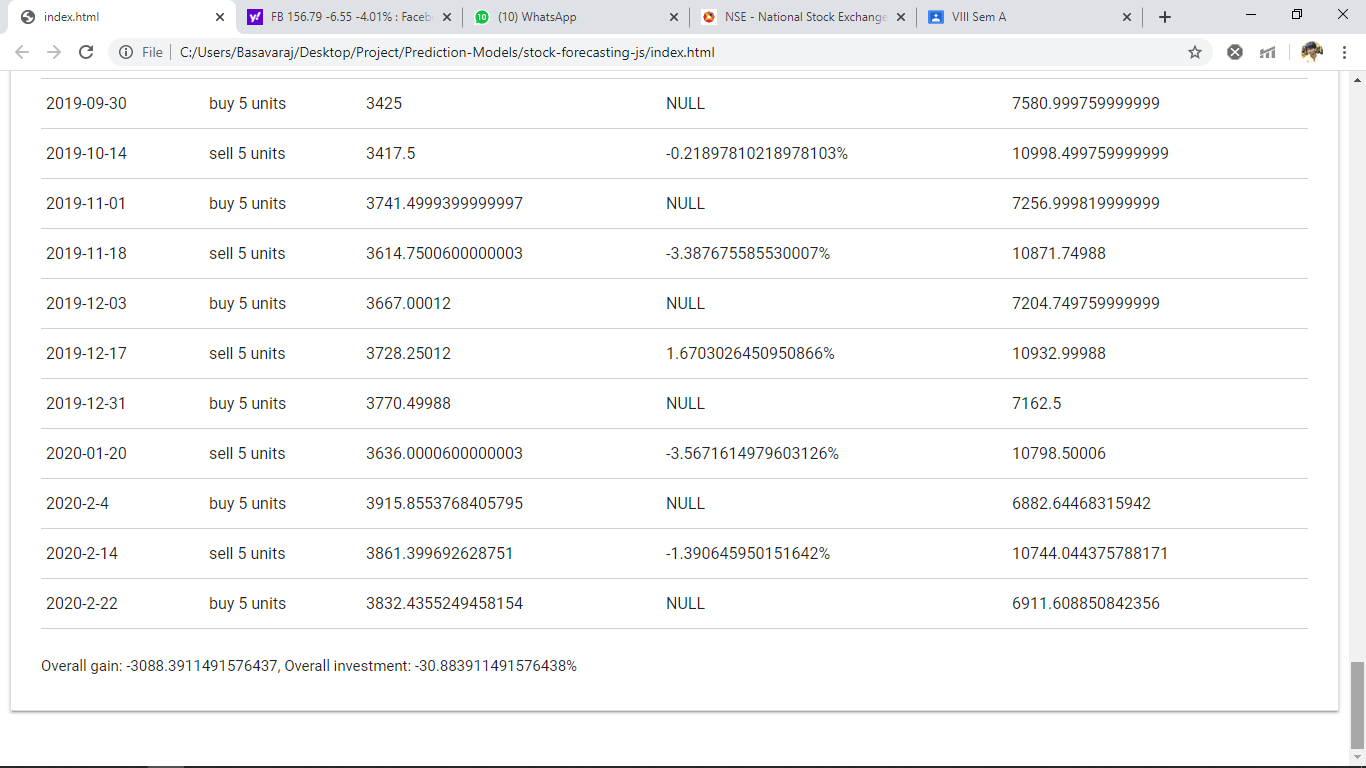
iii

Fig.i8.1.2iSimulationiLogi2

## ResultsiUsingiGraphs:

## ii

Fig.i8.2.1iPriceiGraph

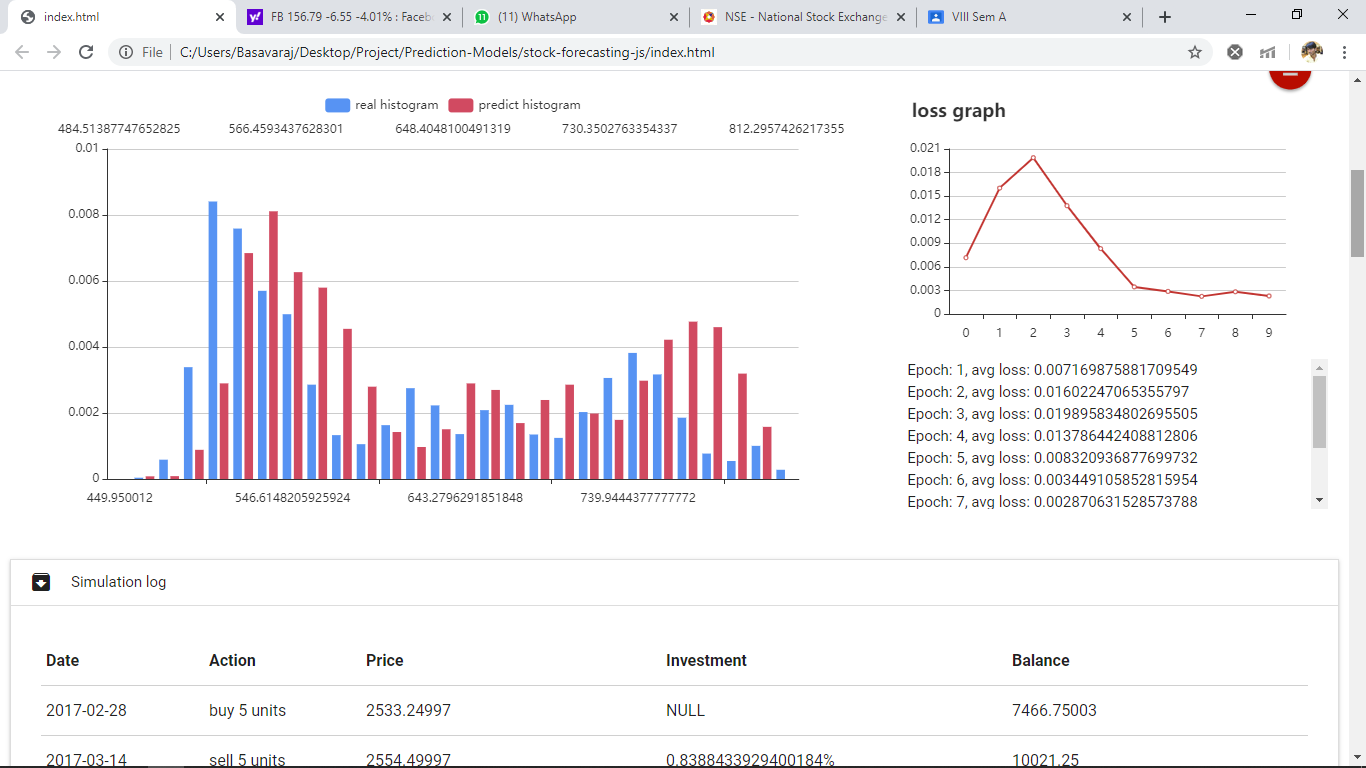
iiiii

Fig.i8.2.2iHistogramiofiStockiPrice

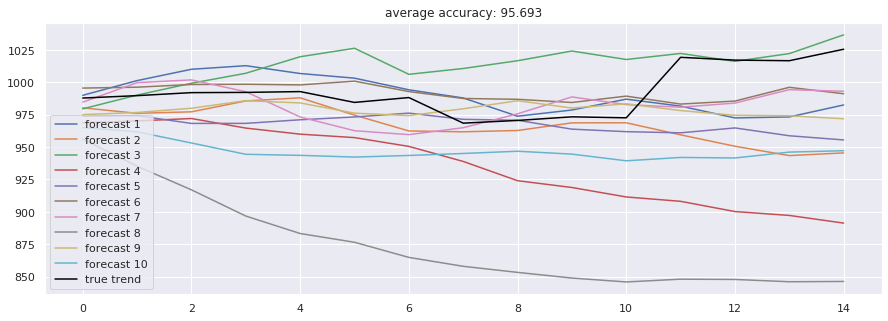


Fig.i8.2.3iiPredictioniUsingiLSTM



Fig.i8.2.4iiPrice-Prediction

# CHAPTERi9

**CONCLUSIONiANDiFUTUREiSCOPE**

TheidifficultyiforiaibeginneritoitheifieldiofiMachineilearningitoiknowiwhatitypeiofinetworkitoiuseiisihigh.iThereiareisoimanyitypesiofinetworksitoichooseifromiandinewimethodsibeingipublishediandidiscussionsiareihappeningieveryiday.iMakingithingsiworse,imostineuralinetworksiareiflexibleienoughithatitheyiworkiandimakeiaipredictionieveniwheniusediwithitheiwrongitypeiofidataioripredictioniproblem.

iiiiiUpgradingitheiarrangementireportsiscaleianditimeiallocationicaniachieveibetteriexpectation.i

iiiiAitradingimodeliusingitheiproposediwayiofithinkingicanibeimadeitoifigureioutrightireturnsioriinterestsidynamically.iThisicaniexhibititheiprecisioniofitheimodel.iThisimodelicanisuccessfullyiendorseitheistocksifori investment.

Potentialiimprovementicanibeimadeitoiouridataicollectioniandianalysisimethod.

Futureiresearchicanibeidoneiwithipossibleiimprovementisuchiasimoreirefinedidataiandimoreiaccurateialgorithm.

Asiisiindentifromifigi8.2.3,i8.2.4,itheipredictioniisifairlyiaccurateiunlessithereiisihugeiandisuddenivariationiinitheiactualidata.

# Chapteri10

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  + https://www.nasdaq.com/
  + https://www.quandl.com/
  + https://www.kaggle.com/