i i i i i i i iREPORT iOF iPROJECT iON i

FACE iRECOGNITION

i i i i i i i i i i i i i i i i i i i i i i i**As ia iproject iwork ifor iCourse i**

i i i i i i i i iARTIFICIAL iINTELLIGENCE i

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Name i i i i i i i i i i i i i i i i i i i i i i i i i i i i i: iAAKASH iSHUKLA

Registration iNumber i i i i i i: i i i11802689

Name i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i: iGAYATRI iNANDAN iMISHRA

Registration iNumber i i i i i i i: i i11802698

Program i i i i i i i i i i i i i i i i i i i i i i i i i i: i i iCSE iB.Tech i

Semester i i i i i i i i i i i i i i i i i i i i i i i i i: i i i4th

iSchool i i i i i i i i i i i i i i i i i i i i i i i i i i i i i: i i iSchool iof iComputer i i i iScience i

Name iof ithe iUniversity i i i: i i iLovely iProfessional iUniversity i

Date iof isubmission i i i i i i i i i i: i i i31st iMarch i2020 i

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i i i i i

Abstract i

**It iis ialways igreat ito ihave isomeone ito iready ito iplay iat iyour iwill iand igive iyou icompany, ibe iit ifor ian iadult ior ichild. iAs iit iis ibeing ihard ifor ihumans ito imeet isomeone ielse’s ineed irobots iare ibeing iimplemented. iIt iis itherefore ineeded ithat ia irobot ican iunderstand ithe iload ithe iimages iit isees. iThus, ithis iproject iis ibased ion iface irecognition.**

ACKNOWLEDGEMENT

**iI iwould ilike ito ithank imy imentor i- iProf. iSagar iPande ifor ihis iadvice iand iinputs ion ithis iproject. iMany ithanks ito imy ifriends iand iseniors ias iwell, iwho ispent icountless ihours ito ilisten iand iprovide ifeedbacks.**

i i i i i i i i i i i i i i i i i

i i i i i i i i i i i i i i i i i

INTRODUCTION

**1.Context i:-**

This iproject ihas ibeen idone ias ipart iof imy icourse ifor ithe iCSE iat iLovely iProfessional iUniversity i. iSupervised iby iSagar iPande, iI ihave ithree imonths ito ifulfill ithe irequirements iin iorder ito isucceed ithe imodule. i

**2.Motivations i:-**

Being iextremely iinterested iin ieverything ihaving ia irelation iwith ithe iMachine iLearning, ithe igroup iproject iwas ia igreat ioccasion ito igive ius ithe itime ito ilearn iand iconfirm iour iinterest ifor ithis ifield. iThe ifact ithat iwe ican imake iestimations, ipredictions iand igive ithe iability ifor imachines ito ilearn iby ithemselves iis iboth ipowerful iand ilimitless iin iterm iof iapplication ipossibilities. iWe ican iuse iMachine iLearning iin iFinance, iMedicine, ialmost ieverywhere. iThat’s iwhy iI idecided ito iconduct imy iproject iaround ithe iMachine iLearning.

**3.Idea i:-**

iA i**facial irecognition isystem** iis ia itechnology icapable iof i[identifying](https://en.wikipedia.org/wiki/Identification_of_human_individuals) ior i[verifying](https://en.wikipedia.org/wiki/Authentication) ia iperson ifrom ia i[digital iimage](https://en.wikipedia.org/wiki/Digital_image) ior ia i[video iframe](https://en.wikipedia.org/wiki/Film_frame) ifrom ia i[video](https://en.wikipedia.org/wiki/Video) isource. iThere iare imultiple imethods iin iwhich ifacial irecognition isystems iwork, ibut iin igeneral, ithey iwork iby icomparing iselected i[facial ifeatures](https://en.wikipedia.org/wiki/Face) ifrom igiven iimage iwith ifaces iwithin ia i[database](https://en.wikipedia.org/wiki/Database_management_system). iIt iis ialso idescribed ias ia iBiometric iArtificial iIntelligence ibased iapplication ithat ican iuniquely iidentify ia iperson iby ianalyzing ipatterns ibased ion ithe iperson's ifacial itextures iand ishape. **i i**

.

i i i i i i i i i

i iTEAM iMEMBERS

TEAM iLEADER:- i

** iAAKASH iSHUKLA**

i i i i i i i i i i iContributions:- i

**i i i i i i i i i i i i i i i i i i i1. i iCoding(joined)**

**i i i i i i i i i i i i i i i i i i i2. i iOPEN iCV**

**i i i i i i i i i i i i i i i i i i i3. i iReports**

**i i i i i i i i i i i i i i i i i i i4. iDEEP iLEARNING**

**GAYTRI iNANDAN iMISHRA**

i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i iContributions:- i

**i i i i i i i i i i i i i i i i i i i i1. iCoding(joined) i**

**i i i i i i i i i i i i i i i i i i i i2. iDLIB**

**i i i i i i i i i i i i i i i i i i i i3. iFACE i\_RECOGNITION**

**i i i i i i i i i i i i i i i i i i i i4. iDLIB iWITH iGPU**

**i i i i i i i i i i i i i i i i i i i i5. imachine ilearning(joined)**

i iLIBRARIES i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i

iface\_recognition:-

Recognize iand imanipulate ifaces ifrom iPython ior ifrom ithe icommand iline iwith ithe iworld’s isimplest iface irecognition ilibrary. iIt iis ibuilt iusing idlib’s istate-of-the-art iface irecognition. iIt iis ibuilt iwith ideep ilearning. iThe imodel ihas ian iaccuracy iof i99.38% ion iLabeled ifaces iin ithe iwild ibenchmark.

This ialso iprovides ia isimple iface\_recognition icommand iline itool ithat ilets

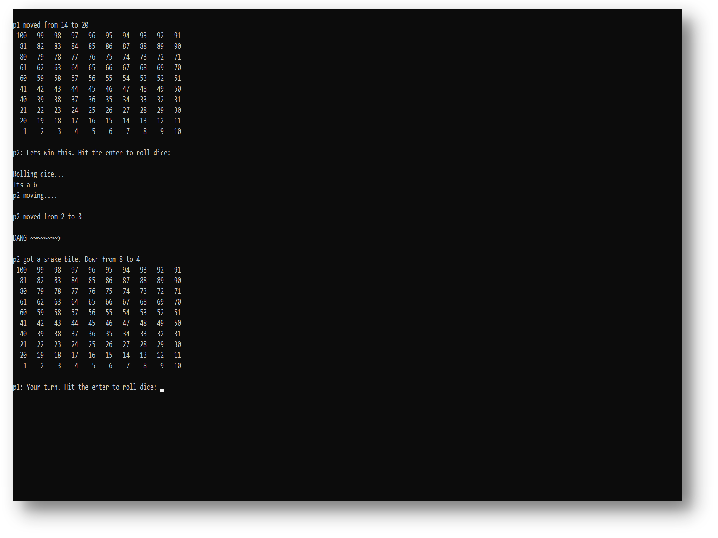
you ido iface irecognition ion ia ifolder iof iimages ifrom ithe icommand iline.

-argparse:

The iargparse imodule imakes iit ieasy ito iwrite iuser-friendly icommand-line iinterfaces. iThe iprogram idefines iwhat iarguments iit irequires, iand iargparse iwill ifigure iout ihow ito iparse ithose iout iof isys.argv. iThe iargparse imodule ialso iautomatically igenerates ihelp iand iusage imessages iand iissues ierrors iwhen iusers igive ithe iprogram iinvalid iarguments.

opencv:-

OpenCV i(Open *i*source *i*computer *i*vision) i iis ia i[library iof iprogramming ifunctions](https://en.wikipedia.org/wiki/Library_(computing)) imainly iaimed iat ireal-time i[computer ivision](https://en.wikipedia.org/wiki/Computer_vision). iOriginally ideveloped iby iIntel, iit iwas ilater isupported iby i[Willow iGarage](https://en.wikipedia.org/wiki/Willow_Garage) ithen iItseez i(which iwas ilater iacquired iby iIntel). iThe ilibrary iis i[cross-platform](https://en.wikipedia.org/wiki/Cross-platform) iand ifree ifor iuse iunder ithe i[open-source](https://en.wikipedia.org/wiki/Open-source_software) i[BSD ilicense](https://en.wikipedia.org/wiki/BSD_license).



iIn ithis ireport, iwe iare igoing ito ishow iface irecognition iin iboth iimages i iand ivideo istreams iusing:

* OpenCV
* Python
* Deep ilearning

As iwe’ll isee, ithe ideep ilearning-based ifacial iembeddings iwe’ll ibe iusing ihere itoday iare iboth i

(1) ihighly iaccurate iand i

(2) icapable iof ibeing iexecuted iin ireal-time.

INTRODUCTION i

A i**facial irecognition isystem** iis ia itechnology icapable iof i[identifying](https://en.wikipedia.org/wiki/Identification_of_human_individuals) ior i[verifying](https://en.wikipedia.org/wiki/Authentication) ia iperson ifrom ia i[digital iimage](https://en.wikipedia.org/wiki/Digital_image) ior ia i[video iframe](https://en.wikipedia.org/wiki/Film_frame) ifrom ia i[video](https://en.wikipedia.org/wiki/Video) isource. iThere iare imultiple imethods iin iwhich ifacial irecognition isystems iwork, ibut iin igeneral, ithey iwork iby icomparing iselected i[facial ifeatures](https://en.wikipedia.org/wiki/Face) ifrom igiven iimage iwith ifaces iwithin ia i[database](https://en.wikipedia.org/wiki/Database_management_system). iIt iis ialso idescribed ias ia iBiometric iArtificial iIntelligence ibased iapplication ithat ican iuniquely iidentify ia iperson iby ianalyzing ipatterns ibased ion ithe iperson's ifacial itextures iand ishape. iWhile iinitially ia iform iof icomputer i[application](https://en.wikipedia.org/wiki/Application_software), iit ihas iseen iwider iuses iin irecent itimes ion imobile iplatforms iand iin iother iforms iof itechnology, isuch ias irobotics. iIt iis itypically iused ias iaccess icontrol iin i[security isystems](https://en.wikipedia.org/wiki/Burglar_alarm) iand ican ibe icompared ito iother i[biometrics](https://en.wikipedia.org/wiki/Biometrics) isuch ias i[fingerprint](https://en.wikipedia.org/wiki/Fingerprint) ior ieye i[iris irecognition](https://en.wikipedia.org/wiki/Iris_recognition) isystems. iAlthough ithe iaccuracy iof ifacial irecognition isystem ias ia ibiometric itechnology iis ilower ithan i[iris irecognition](https://en.wikipedia.org/wiki/Iris_recognition) iand i[fingerprint irecognition](https://en.wikipedia.org/wiki/Fingerprint), iit iis iwidely iadopted idue ito iits icontactless iand inon-invasive iprocess. iRecently, iit ihas ialso ibecome ipopular ias ia icommercial iidentification iand imarketing itool.

The iDEEP iLEARNING

The isecret iis ia itechnique icalled i**deep imetric ilearning.**

we itypically itrain ia inetwork ito:

* Accept ia isingle iinput iimage
* And ioutput ia iclassification/label ifor ithat iimage

However, ideep imetric ilearning iis idifferent.

Instead, iof itrying ito ioutput ia isingle ilabel i(or ieven ithe icoordinates/bounding ibox iof iobjects iin ian iimage), iwe iare iinstead ioutputting ia ireal-valued ifeature ivector.

For ithe idlib ifacial irecognition inetwork, ithe ioutput ifeature ivector iis i128-d i(i.e., ia ilist iof i128 ireal-valued inumbers) ithat iis iused ito iquantify ithe iface. iTraining ithe inetwork iis idone iusing itriplets:

**STEPS i:**

**i i i i i i i i i i i i i i i i i i i i**

dataset/

* i: iContains iface iimages ifor isix icharacters iorganized iinto isubdirectories ibased ion itheir irespective inames.

examples/

* i: iHas ithree iface iimages ifor itesting ithat iare inot iin ithe idataset.

output/

* i: iThis iis iwhere iwe ican istore iour iprocessed iface irecognition ivideos. iThere iis ione iin ithe ifolder i— ithe iclassic i“lunch iscene” ifrom ithe ioriginal iJurassic iPark imovie.

videos/

* i: iInput ivideos iis istored iin ithis ifolder. iThis ifolder ialso icontains ithe i“lunch iscene” ivideo.

**PROCESS**

For ieach iiteration iof ithe iloop, iwe’re igoing ito idetect ia iface i(or ipossibly imultiple ifaces iand iassume ithat iit iis ithe isame iperson iin imultiple ilocations iof ithe iimage.

For iexample, ilet’s isay ithat i

iour iimage icontains ia ipicture i(or ipictures) iof iEllie iSattler’s iface.

Our icode ican iactually ifind/localize ithe ifaces iof iher iresulting iin ia ilist iof iface i

boxes

i. iWe ipass itwo iparameters ito ithe i

face\_recognition.face\_locations

i imethod:

image

* i: iOur iRGB iimage

model

* i: iEither icnn
* i ior ihog
* i(this ivalue iis icontained iwithin iour icommand iline iarguments idictionary iassociated iwith ithe i

"detection\_method"

* i ikey). iThe iCNN imethod iis imore iaccurate ibut islower. iHOG iis ifaster ibut iless iaccurate.

Then, iwe’re igoing ito iturn ithe ibounding i

boxes

i iof iEllie iSattler’s iface iinto ia ilist iof i128 inumbers ion iLine i45. iThis iis iknown ias iencoding ithe iface iinto ia ivector iand ithe i

face\_recognition.face\_encodings

i imethod ihandles iit ifor ius.

From ithere iwe ijust ineed ito iappend ithe iEllie iSattler i

Encoding iand iname ito ithe iappropriate ilist i(knownEncodings iand iknownNames).

We’ll icontinue ito ido ithis ifor iall i218 iimages iin ithe idataset.

What iwould ibe ithe ipoint iof iencoding ithe iimages iunless iwe icould iuse ithe i

encodings

i iin ianother iscript iwhich ihandles ithe irecognition?

IMAGES

A close up of a person

Description automatically generated

A person wearing a hat and glasses

Description automatically generated

A person smiling for the camera

Description automatically generated

A person looking at the camera

Description automatically generated

CONCLUSION i

The ifacial iexpression irecognition isystem ipresented iin ithis iresearch iwork icontributes ia iresilient iface irecognition imodel ibased ion ithe imapping iof ibehavioural icharacteristics iwith ithe iphysiological ibiometric icharacteristics. iThe iphysiological icharacteristics iof ithe ihuman iface iwith irelevance ito ivarious iexpressions isuch ias ihappiness, isadness, ifear, ianger, isurprise iand idisgust iare iassociated iwith igeometrical istructures iwhich irestored ias ibase imatching itemplate ifor ithe irecognition isystem. iThe ibehavioural iaspect iof ithis isystem irelates ithe iattitude ibehind idifferent iexpressions ias iproperty ibase. iThe iproperty ibases iare ialienated ias iexposed iand ihidden icategory iin igenetic ialgorithmic igenes. iThe igene itraining iset ievaluates ithe iexpressional iuniqueness iof iindividual ifaces iand iprovide ia iresilient iexpressional irecognition imodel iin ithe ifield iof ibiometric isecurity.

**Machine iLearning i i:-**

**iMachine ilearning iis ia itype iof iartificial iintelligence i(AI) ithat iprovides icomputers iwith ithe iability ito ilearn iwithout ibeing iexplicitly iprogrammed. iMachine ilearning ifocuses ion ithe idevelopment iof iComputer iPrograms ithat ican ichange iwhen iexposed ito inew idata.**

i**Supervised iLearning i i:-**

**iSupervised ilearning iis ithe imachine ilearning itask iof ilearning ia ifunction ithat imaps ian iinput ito ian ioutput ibased ion iexample iinput-output ipairs.[1] iIt iinfers ia ifunction ifrom ilabeled itraining idata iconsisting iof ia iset iof itraining iexamples. i• iSupervised ilearning iis iwhen ithe imodel iis igetting itrained ion ia ilabelled idataset. i• iLabelled idataset iis ione iwhich ihave iboth iinput iand ioutput iparameters.**

i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i

i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i i**REFERENCES i**

Since i[***Jurassic iPark***](https://www.imdb.com/title/tt0107290/) i(1993) iis ia ifavorite imovie iof iall itime, iwe iare igoing ito iapply iface irecognition ito ia isample iof ithe icharacters iin ithe ifilms:

* [**Alan iGrant**](http://jurassicpark.wikia.com/wiki/Alan_Grant), ipaleontologist i
* [**Claire iDearing**](http://jurassicpark.wikia.com/wiki/Claire_Dearing), ipark ioperations imanager i
* [**Ellie iSattler**](http://jurassicpark.wikia.com/wiki/Ellie_Sattler), ipaleobotanist i
* [**Ian iMalcolm**](http://jurassicpark.wikia.com/wiki/Ian_Malcolm), imathematician i
* [**John iHammond**](http://jurassicpark.wikia.com/wiki/John_Hammond), ibusinessman/Jurassic iPark iowner i
* [**Owen iGrady**](http://jurassicpark.wikia.com/wiki/Owen_Grady), idinosaur iresearcher i
* SOME iINFORMATION iFROM iWIKIPEDIA