Universities as Drivers of AI Research and Innovation

Kiran Trivedi, PhD
Associate Professor
Electronics & Communication Engineering
Gujarat Technological University, India
krtrivedi@gmail.com

Outline

- Universities and AI research- evidential overview
- AI for All - Need to influence University curriculum.
- Limitations and constraints on AI research in Universities.
- Case Study
- Summary and takeaway

Introduction

- Universities are the pioneer in AI research and innovation.
- Majority of the Datasets are prepared by universities worldwide.
- Most AI startups have born from colleges.
- Huge amount of publications on AI are from university professors.
- Concept of AI University has also emerged.
- Quantum of research is more at the universities.
- Industries are bringing products from university research.

How Universities Can Become Key Drivers of AI Research and Innovation?

The Approach

- The state of adaption of AI at Academia - Industry
- SWOT analysis for AI for Academia-Industry
- Formation of an AI policy for Academia-Industry
- Prioritizing localized AI R&D in country of university to meet the SDGs
- Cultural and geographical AI innovations can be leveraged.

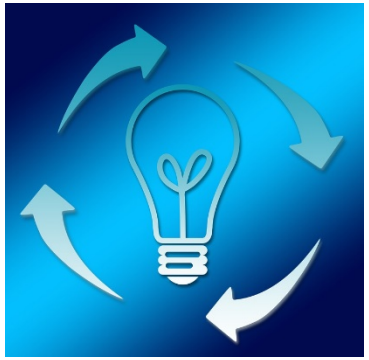
Philosophy

- Industries initiation for skilling their workforce with help of university to enable them for AI revolution
- Universities are adapting on their curricula to include courses on AI
- Universities and online AI courses – mixed bag
- Individuals and professionals – updating their skills - online/offline
- University – Global AI participation
- New business models at University level for AI research

University Pockets for Research

- Inter-University collaboration
- Geographical clusters of university
- Faculty contribution on the boards of industry
- Industry support to university research

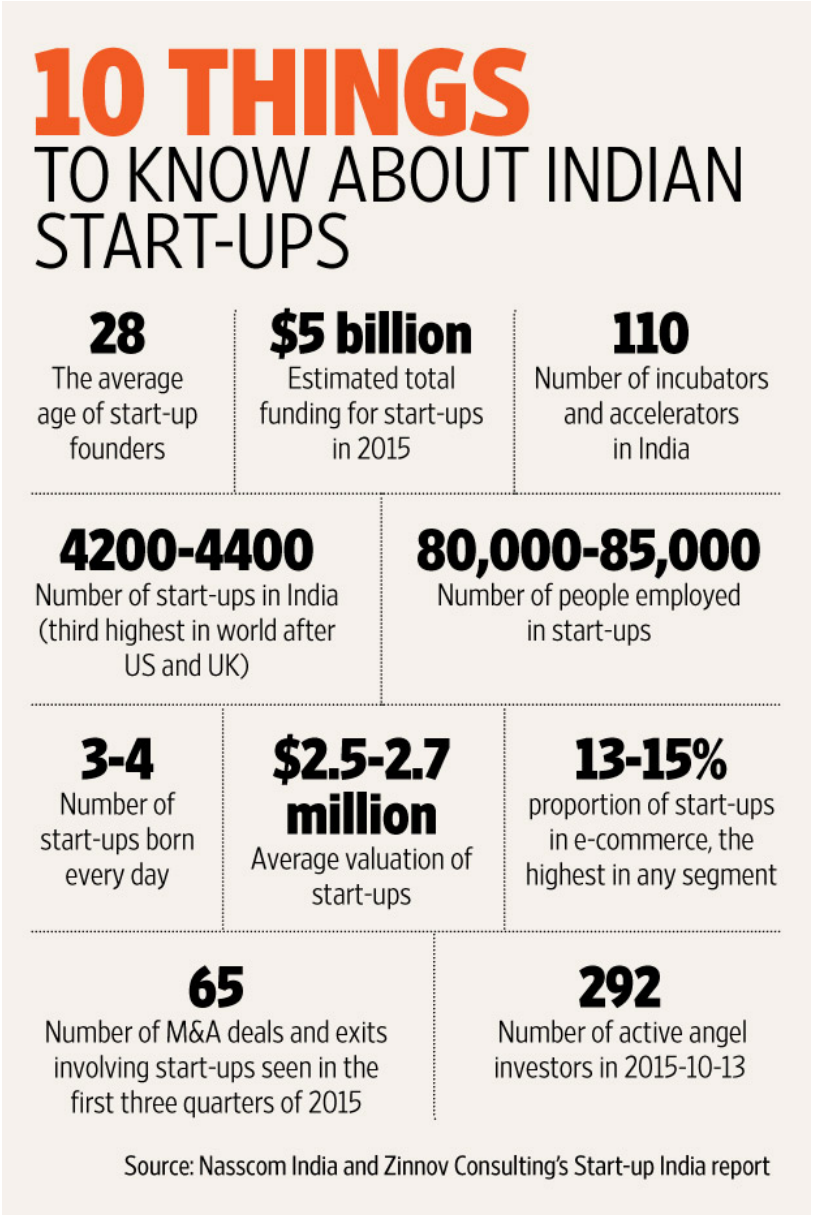
NITI Aayog – Think Tank of India



- Precision AI - real-time advisory based on satellite imagery, weather data, etc. to increase farm yields where the farm production levels are low with major IITs and Government support
- Early diagnosis and detection of Diabetic Retinopathy and Cardiac Risk based on the AI models.
- Indian Languages Project –a long-term project to build a complete natural language processing platform for 22 Indian languages.
- Government support to both- academia and industry for AI

Startups

- Rise of technology based startups
- AI startups
- Israel is leading in all kind of startups mainly AI startups.
- Government policies for university and commerce plays pivotal role.
- India, France, USA, China, UK and Israel are bringing quick change in their policies
- Innovation promotion is happening worldwide in the form of hackathons at university by young students
- Startups should not be taken by big companies to kill the innovative rising competitors



to meet the challenges of AI

- Focus on curriculum in every discipline- to meet the challenges and increasing adaptability.
- Applied Mathematics for AI
- University and Industry can jointly develop software-hardware tools to solve the limitations of AI
- CO and PO of the curriculum to address problem solutions using AI

AI4All == Subject4All

- AI is not the subject area of any specific branch now.
- Still there is hesitation to accept as subject for non-ICT branches
- Preparing experts from every branch of university in AI.
- AI needs to be taught as fundamental subject from schools.
- Platform development to PR the AI research

ICT is now AI-ICT

- There are tremendous efforts from UNESCO, ITU, IBE, UNEVOC, WHO to promote ICT, now it must be backed up with AI in ICT
- AI ICT based hackathons, meetups, startup pitches should be encouraged for the university students.
- Competitions provides a platform to highlight the work to the rest of the world.
- Publications to reputed journals and conferences should be available for free.

Priority Approach to Leadership in AI

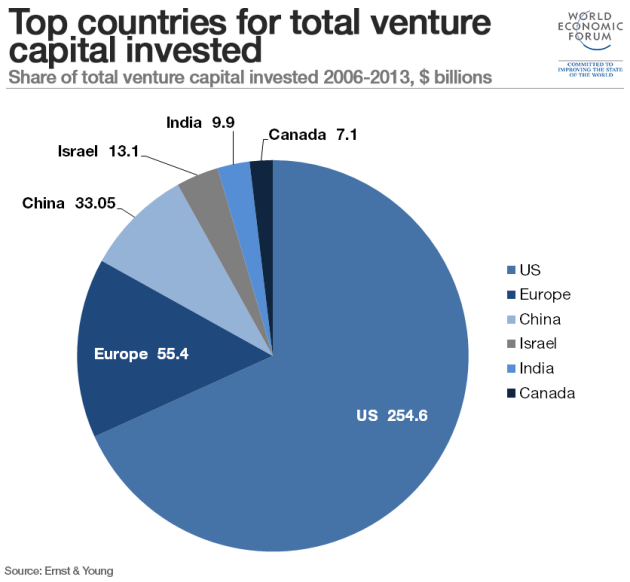
- AI can be the next power house of next generation economies.
- Till date, AI is driven for commercial perspective.
- Following sectors are envisioned where much can be done using AI
  - Medical and Healthcare
  - Smart villages and Sustainable Infrastructure
  - Agriculture
  - Smart Transportation and Mobility
  - Education

AI Research at Universities– Strengths and Opportunities

- Strong existing IT sector and well known universities
- Man power with AI skills
- Government push for digitization
- Diversity in culture means – diversity in data
- Existing foundation of US-UK-India-Europe-China for AI boost
- Use of strong IT service sector
- Exponential increase of online users

Weaknesses and Threats

- Little more hype about AI
- Limited funding for long term research at university
- Lack of long term planned collaboration between academia-industry



Barriers for AI

- Few collective methodology to implementation and application of AI
- Privacy, security, regulations, ethics and standardization for data
- Costly resources and low awareness for adaption of AI
- No easy access to intelligent and important data
- Lack of wide range of expertise in development of AI

Creation of Universal Sense of Ethics

- Industry and Academia both are yet to achieve this in AI
- Domain specific ethics in AI
- Rules, regulation and standards for ethics are the demand of the day
- Common platform and testing before launching the AI for all
- AI development across the world is with no control as there is no regulatory body yet, no policies yet adopted

Current Scenario of Indian Academia-Industry in AI

- Indication of grassroots level AI in small university
- Only AI pilot projects from the government and some startups
- Economy - slow broad AI adoption.
- The Indian government and Indian tech hubs are certainly aware of (and often excited about) AI, but adoption lags interest.
- University need to start data centers for AI
- Government funding for healthcare needs little diversion for AI healthcare research at university

Global Scenario of AI

- UK and China expects increase in GDP in 2030 from AI
- US – AI report published – 2016
- France – AI strategy published -and 2018
- Japan – 2017
- China – AI strategy – 2017
- US, China and Japan are leading in core AI research publications
- CMU, MIT and Stanford and many Chinese universities to early start the AI research courses
- UK has planned using Turing fellowship for 1000 PhD cohorts in AI
- First AI University – Mohamad Bin Zayed University of AI in UAE

Indian Scenario

- India is aggressive to be the AI garage for 40% of the world
- Solve for India means solve for world as India is 2nd largest economy
- NITI Aayog is taking lead in policy making for AI

Areas to Address First – AI Intermediation

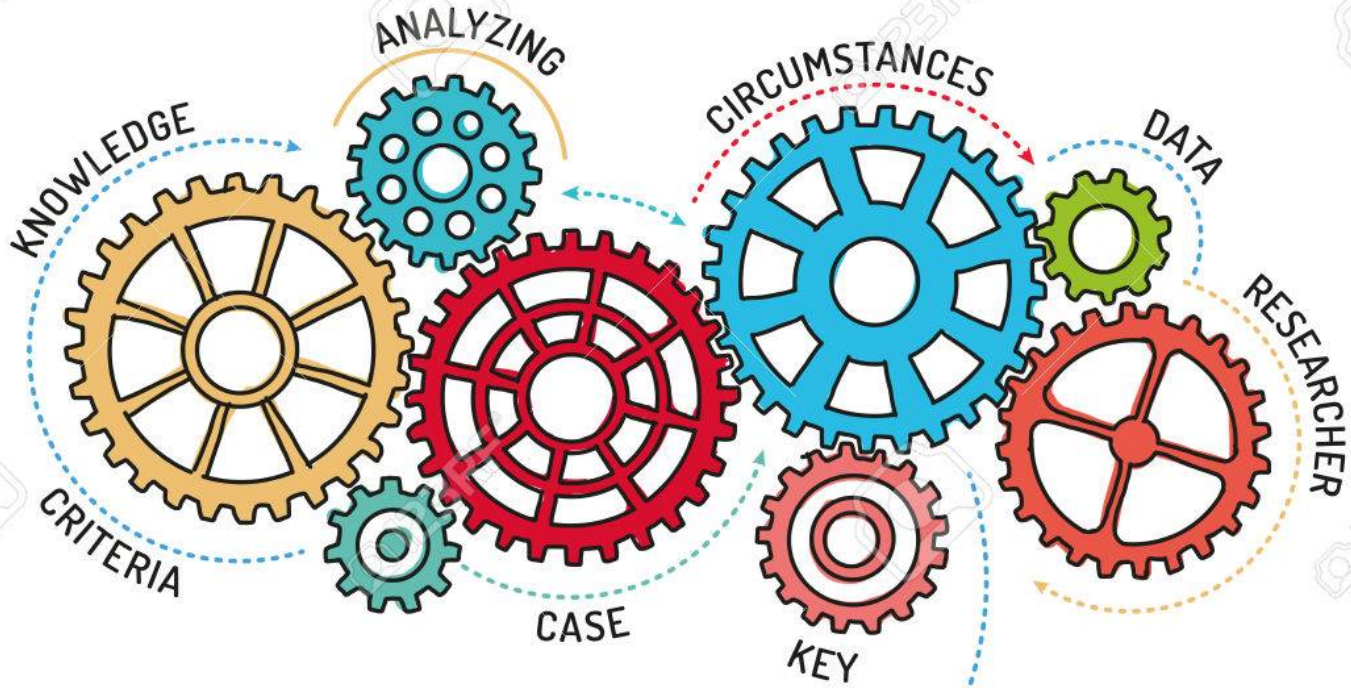
- Healthcare
- Agriculture
- Education
- Smart cities and sustainable infrastructure
- Intelligent transport and mobility

Key Challenges

- Data ecosystem
- Core fundamental research
- Transforming research to industry and government – Tech transfer
- High cost of research and low awareness to implement in business
- Digital barriers
- IPR policies
- Lag in developing policies and law for privacy, ethical and security regulations
- Absence of collaboration among universities and industries

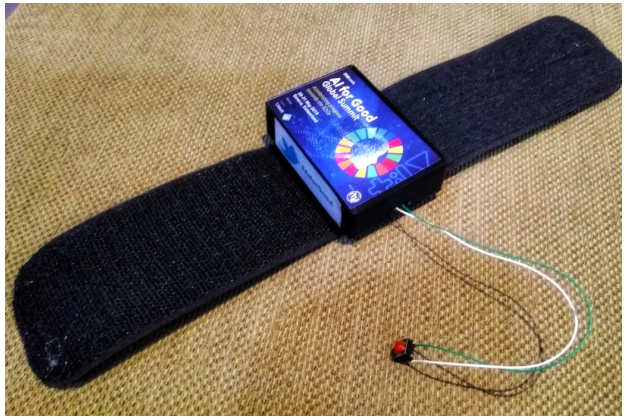
Suggestions

- AI research at universities – less incentivized in underdeveloped countries
- Skill development for AI wave
- Innovators are running fast and adaptors are lagging behind
- Too much to do for ‘Responsible AI’ and ‘Explainable AI’
- Governments and Industries are mainly focusing on problems mainly of 2% rich populations of the world.
- Many problems in the world at rural and remote areas to solve using AI.


ANALYZING
CIRCUMSTANCES
KNOWLEDGE
DATA
RESEARCHER
CRITERIA
CASE
KEY

Case Study

AI4Good – Gesture for Communication



AI for Brainwaves

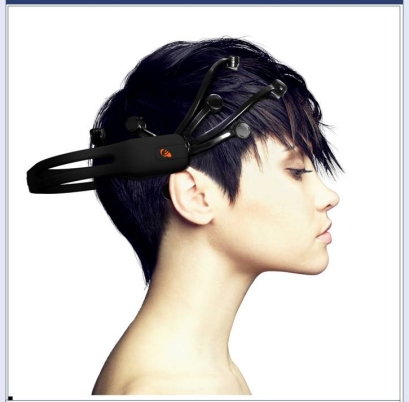
Study and Analysis of Human Brainwave, and Development of Multi-functional Communication Device

Kiran R. Trivedi, PhD Scholar, RK University, Research Advisor : Dr. Rajesh A Thakker, PhD(IITB)
Shantilal Shah Engineering College, Bhavnagar. (TEQIP Institute)

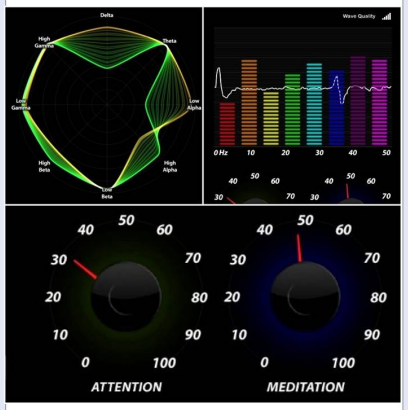
Introduction

This Poster Introduces prototype of Human Brainwave enabled multifunctional communication device using low cost wireless EEG devices. The prototype implicates the future of wearable devices for human assistance

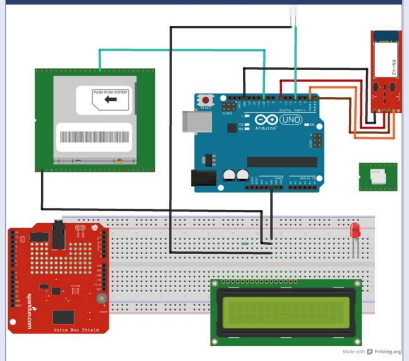
Low Cost Wireless EEG Headsets - Emotiv



Brainwave Visualizer for Attention / Meditation

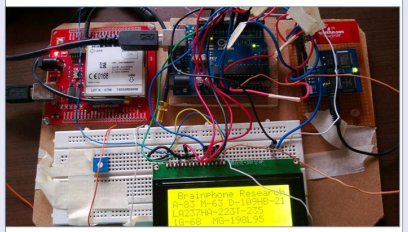


Fritzing Diagram



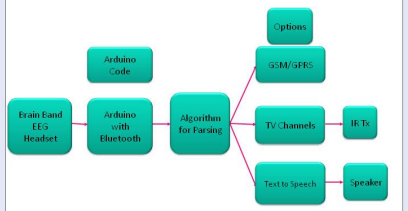
Basic Building Blocks

Prototype in Progress..



Twitter and Facebook Updates via Brainwaves

Block Diagram / System Design



Heart Beats – Brain Tweets during Dreams

Result

Dual Sensor EEG Headset

To help disabled and elderly people to communicate using attention value obtained from Brainwave, we have integrated various modules like Arduino, Telit GM862, Emic TTS, Bluesmirf and EEG Headset. The prototype is capable of communicating in real-time EEG

CONTACT

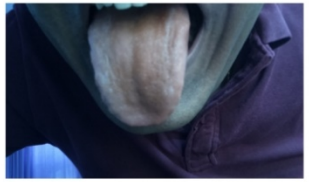
Kiran R. Trivedi,
PhD Scholar, School of Engineering, RK University, Rajkot, Gujarat
[Associate Professor, EC Engineering, Shantilal Shah Engineering College (TEQIP Institute)]
Sidsar Campus, Bhavnagar, Gujarat. (INDIA)
E-mail krtrivedi@gmail.com
Dr. Rajesh A. Thakker, PhD(IITB)
Professor & Head, EC Engineering Dept,
VGEC Chandkheda, Gandhinagar, Gujarat.(INDIA)

AI Prescription

AI Generated Prescription!

Opalescent

Rx



This tounge is primarily diagonised with following probable symptoms.

Folic_acid

Reboflamine

Vitamin_problem

Cobalmine

Infectious

Lactrile

Biotiu

AI for Forensics

AI in Education - Person Identification from Handwritings using Artificial Intelligence on Raspberry Pi

Dhwani Trivedi , Dr. Kiran R. Trivedi

BVM Engineering College, V.V.Nagar & Shantilal Shah Engineering College, Bhavnagar. Gujarat Technological University

Introduction

This poster introduces Raspberry Pi based AI system for person identification from their handwritings. **Artificial Neural Networks or Perceptron** which are nothing but an artificial neurons of how human brains actually work. Google has developed an amazing pre-trained model called **Inception V3.** In our case, the model will label input images based on what it previously learned like Supervised Learning.

Transfer Learning with Inception Model

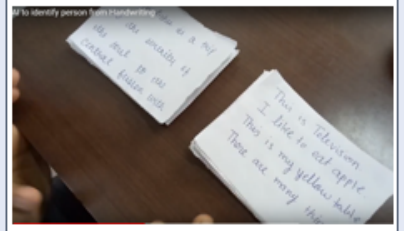
Why Transfer Learning ?

When we study classifying images, we usually build our new model for greater accuracy, This is the solution but building a custom deep learning model requires huge dataset and high power computing devices for lots of training data. Moreover, there already exists a pre-models Inception by Google, that performs pretty well in classifying images from various categories. The popular one is ImageNet, and its Large Visual Recognition Challenge in which models try to classify a large number of images into 1000 classes, Inception V3 is the model Google Brain Team has built for the same. The model is so powerful, popular, light and easy to work with very less number of images to use for Transfer Learning. Inception is a pre trained convolutional neural network model on 1,000,000 into thousand categories.

Basic Steps

- Collection of the handwritten texts of two different persons for Training Image data for classification.
- Taking photos of these handwritten texts and keeping them in separate folders for training
- Train the Inception image classifier using our new data of handwritten texts photos
- Porting the trained model to Raspberry pi
- Create the Handwriting Identifier on Raspberry pi

Handwritten Texts on Papers



Raspberry Pi B+ with Camera

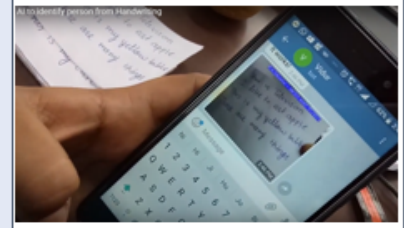
Handwritten Text Datasets Photos

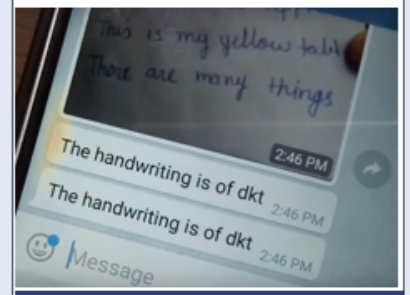
Following are the two separate datasets of images of handwritten texts of two different persons

Testing of AI system

Result

The Test image is sent on Telegram Messenger





Click on QR Code for YouTube Video

CONTACT

Dhwani K. Trivedi
UG Student at BVM Engineering College,
Vallabh Vidhyanagar, Gujarat. (INDIA)
E-mail : dhwanitrivedi999@gmail.com,

Dr. Kiran R Trivedi
Professor at Shantilal Shah Engineering College,
Sidhsar Campus, Bhavnagar, Gujarat. (INDIA)
E-mail :krtrivedi@gmail.com

AI to Identify Potato Weight

AI in Education - Identifying the weight of Potatoes using Artificial Intelligence on Raspberry Pi

Dhwani Trivedi , Dr. Kiran R. Trivedi

BVM Engineering College, V.V.Nagar & Shantilal Shah Engineering College, Bhavnagar. Gujarat Technological University

Introduction

This poster introduces Raspberry Pi based AI system for person identification from their handwritings. **Artificial Neural Networks or Perceptron** which are nothing but an artificial neurons of how human brains actually work. Google has developed an amazing pre-trained model called **Inception V3.** In our case, the model will label input images based on what it previously learned like Supervised Learning.

Transfer Learning with Inception Model

Why Transfer Learning ?

When we study classifying images, we usually build our new model for greater accuracy, This is the solution but building a custom deep learning model requires huge dataset and high power computing devices for lots of training data. Moreover, there already exists a pre-models Inception by Google, that performs pretty well in classifying images from various categories. The popular one is ImageNet, and its Large Visual Recognition Challenge in which models try to classify a large number of images into 1000 classes, Inception V3 is the model Google Brain Team has built for the same. The model is so powerful, popular, light and easy to work with very less number of images to use for Transfer Learning. Inception is a pre trained convolutional neural network model on 1,000,000 into thousand categories.

Basic Steps

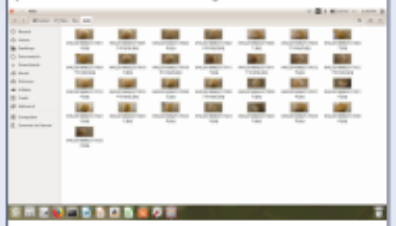
- Collection of the different samples of potatoes of different weights for Training Image data for classification.
- Taking photos of these potatoes respective of their weights and keeping them in separate folders for training
- Train the Inception image classifier using our new data of Potatoes photos
- Porting the trained model to Raspberry pi
- Create the Potato weight Identifier on Raspberry pi

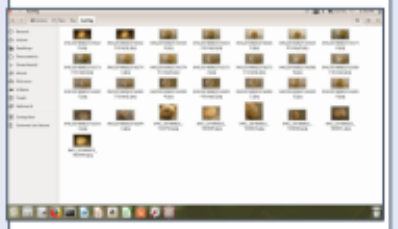
Potatoes of different shapes and size of different weights

Raspberry Pi B+ with Camera

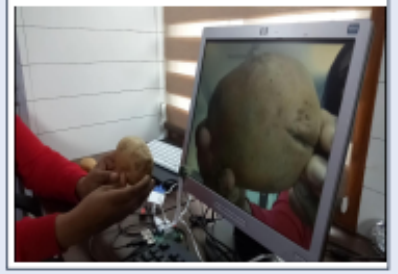
Potatoes of different weights Datasets Photos

Following are the two separate datasets of images of potatoes in three different weights



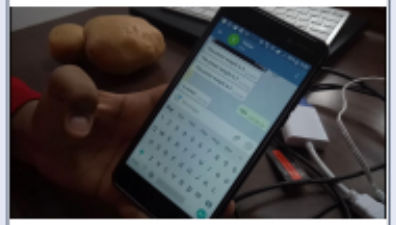


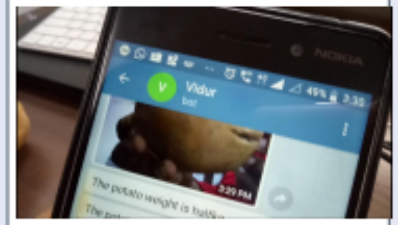
Testing of AI system



Result

The Test image is sent on Telegram Messenger





Click on QR Code for YouTube Video

CONTACT

Dhwani K. Trivedi
UG Student at BVM Engineering College,
Vallabh Vidhyanagar, Gujarat.(INDIA)
E-mail : dhwanitrivedi999@gmail.com,

Dr. Kiran R Trivedi
Professor at Shantilal Shah Engineering College,
Sidhsar Campus, Bhavnagar, Gujarat.(INDIA)
E-mail :krtrivedi@gmail.com

AI for Gender Detection

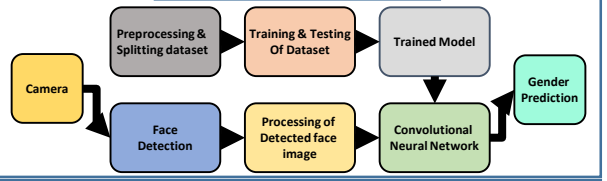
Gender Classification using CNN by Machine Learning approach on Raspberry Pi platform

Mitulgiri H. Gauswami, Research Advisor: Dr. Kiran R. Trivedi
Shantilal Shah Engineering College, Bhavnagar

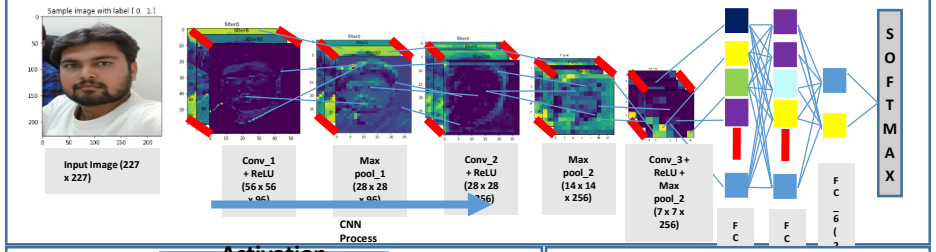
Introduction

This Poster introduces the real time implementation of gender classification system on Raspberry Pi hardware module using Convolutional Neural Network by Machine Learning approach. A person's face detected by camera module interfaced with Raspberry Pi is classified into two classes, whether it is 'male' or 'female', for which it will first be preprocessed, then it will be used in CNN process.

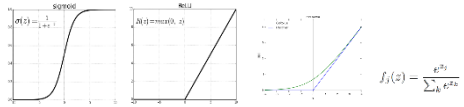
Block Diagram



Convolutional Neural Network

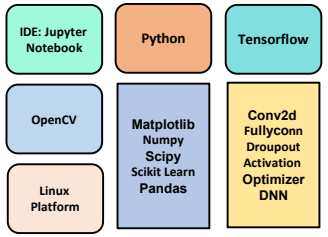


Activation Functions

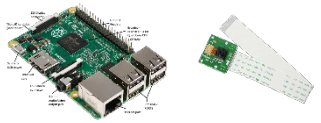


- ✓ The main reason why we use sigmoid function is because it exists between **(0 to 1).** Therefore, it is especially used for models where we have to **predict the probability** as an output. Since probability of anything exists only between the range of **0 and 1,** sigmoid is the right choice.
- ✓ ReLU is used in almost all the convolutional neural networks or deep learning. The ReLU is half rectified (from bottom).It is f(s) is zero when z is less than zero and f(z) is equal to z when z is above or equal to zero.
- ✓ The SoftMax function is a more generalized logistic activation function which is used for multiclass classification. For optimizing models, including machine learning models, it is required that functions describing the model be differentiable.

Technology Stack

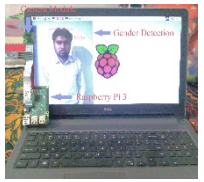


Raspberry Pi 3



- ✓ System on-chip: BCM2837
- ✓ CPU: 1.2 GHz quad-core ARM Cortex A53
- ✓ GPU: Broadcom Video-core IV @400 MHz
- ✓ Memory: 1 GB LPDDR2-900 SDRAM
- ✓ USB Port: 4
- ✓ Network: 10/100 Mbps Ethernet,
- ✓ 802.11n Wireless LAN and Bluetooth 4.0
- ✓ Camera Module Pixel Resolution 2592 x 1944.
- ✓ Interfaced with 15 inch ribbon cable to dedicated 15-pin Camera Serial Interface (CSI) for high data rates.

Prototype



- ✓The prototype explores the future of smart security cameras. The future work will exploit this system to identify the persons by their movement and facial expressions.
- ✓The system indicates the future application for security & surveillance Authentication, Social Media platforms etc.

XXXII Gujarat Science Congress 2018
Organized by

Contact

Mitulgiri H. Gauswami
Enrolment no.: 160430705004
ME Semester-IV Communication System
Shantilal Shah Engineering College, Bhavnagar
Email: mitul.giri@gmail.com

Dr. Kiran R. Trivedi
Associate Professor
Electronics & Communication Engineering
Shantilal Shah Engineering College, Bhavnagar

Summary and Takeaway

- More collaboration
- Focus on Data and Ethics
- Policy, Standards and Regulations
- Pockets of Universities and localized research
- Promotional research scholar scheme and internships for AI
- Hackathons and Bootcamps
- IPR reforms at WIPO