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Detecting Students' Understanding Automatically with Machine Learning

Dr. Haitham Maarouf

Modern University for Business & Science

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Introduction

- Due to the COVID-19 pandemic, all academic institutions moved toward the online learning approach. During the online teaching sessions, most professors usually ask students whether they understand or not; Most students are less likely to answer that they don't understand although they may suffer of this misunderstanding and lack of communication.

- Moreover, an additional question has arisen as a result of this pedagogical shift: How to predict if students understand online lectures without asking or testing them?

- In this presentation, we will try to answer the following question:
  To what extent is it possible to build a smart system with Artificial Intelligence and Machine Learning in order to predict students' understanding based on their facial expressions or emotions?

What is Artificial Intelligence (AI) and Machine Learning (ML)?

- Artificial Intelligence (AI) is the science that allows the building of a smart machine that can perform tasks based on human intelligence.

- Machine Learning (ML) is a subclass of Artificial Intelligence (AI) that allows computer systems to learn and to improve their performance automatically based on experience without the need for human intervention and without being explicitly/previously programmed.

- Machine Learning (ML) is used to solve problems that require non-traditional programming techniques and innovative tools. For example, we can mention in this context: self-driving cars, robotics, language processing, vision processing, forecasting event like stock market trends, the weather fluctuations, sport games and many other occurrences.

Emotions Detection Methods Using Machine Learning

Basic Human Emotions Categories

- Neutral
- Happy
- Surprise
- Angry
- Disgust
- Fear
- Sad

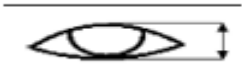## Emotions Detection Methods

- Speech Recognition
- Biosignals
- Body Gestures and Movements
- Motor Behavioral Patterns
- Facial Recognition

Extraction of Facial Elements

In order to detect emotions through facial expressions, the following distances must be calculated:

	Distance between upper and lower eyelids
	Distance between the interior corner of the eyebrow and the interior corner of. the eye
	Distance between left and right mouth corners.
	Distance between upper and lower lips.
	Distance between a corner of the mouth and the corresponding external eye corner.

Facial Expressions or Emotions (Cont.)

Face Detection

Neutral	0 %
Happy	0 %
Surprise	0 %
Angry	0 %
Disgust	0 %
Fear	0 %
Sad	0 %

Status: Face Found!

Neutral

Neutral	100 %
Happy	0 %
Surprise	0 %
Angry	0 %
Disgust	0 %
Fear	0 %
Sad	0 %

Status: Tracking the face...

Surprise

|	
Neutral	0 %
Happy	0 %
Surprise	100 %
Angry	0 %
Disgust	0 %
Fear	0 %
Sad	0 %

Status: Tracking the face...

Happy

Neutral	0 %
Happy	86 %
Surprise	0 %
Angry	2 %
Disgust	13 %
Fear	0 %
Sad	0 %

Status: Tracking the face...

Learner's State of Mind

- According to the study's assumptions, there are two different states of Mind during the online lectures; "Understand" and "Not Understand". The facial emotions will be combined to asses learners' state of mind.
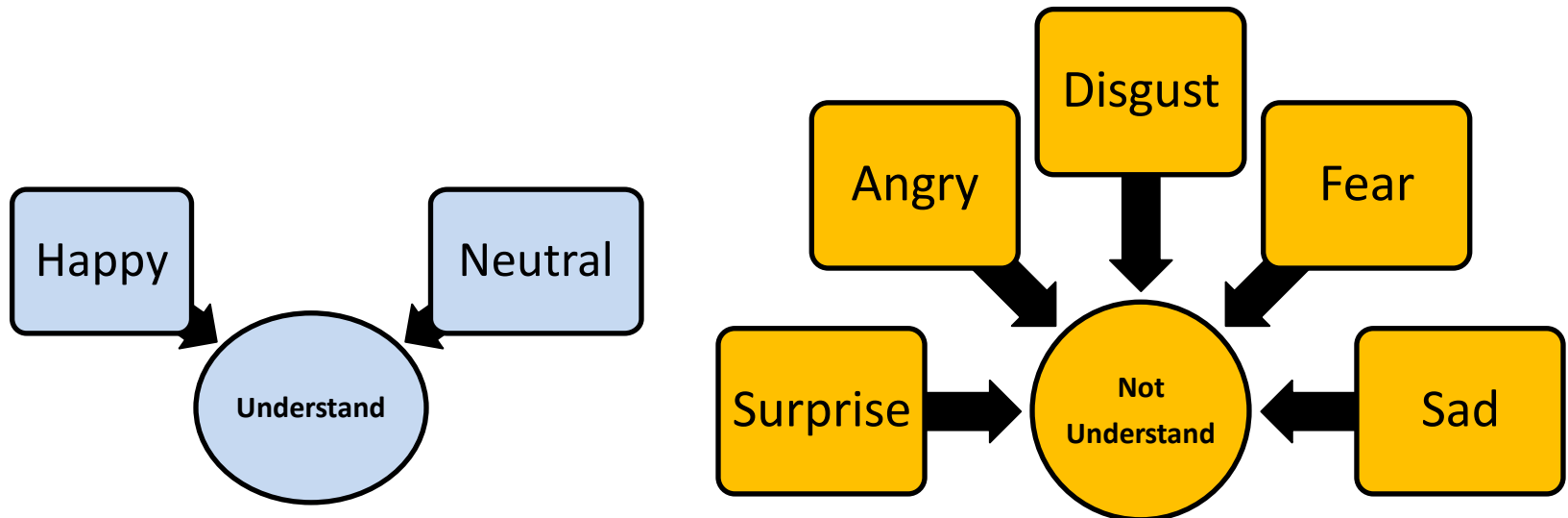
Machine Learning Model

Challenges

The main challenges for a successful usage of artificial intelligence in teaching online:

1. Psychological Understanding of the Facial Motions may not be Accurate

2. Poor Image Quality Limits Facial Recognition's Effectiveness

3. Little Image Sizes Make Facial Reading More Difficult

4. Diverse Face Angles Can Undermine the Recognition's Reliability

Thanks for your kind attention!