Capstone Project

FACE EMOTION RECOGNITION

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Emotion is one of the very few words in the English language that do not have a concrete definition and it is understandable. It is abstract. Yet, almost every decision we have ever made in our lives is driven by emotion. Marketing research has proven that predicting sentiments correctly can be a huge source of growth for businesses and that's what we will be working on today — Reading Emotions. In the world of data and machine learning, this concept falls under the umbrella of cognitive systems. Let us try to decode the science behind Emotion Recognition Algorithms, and build one for ourselves.

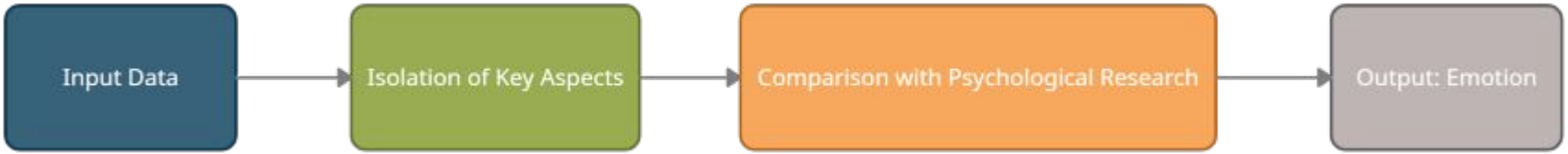
Cognitive Science and Sentiment Analysis

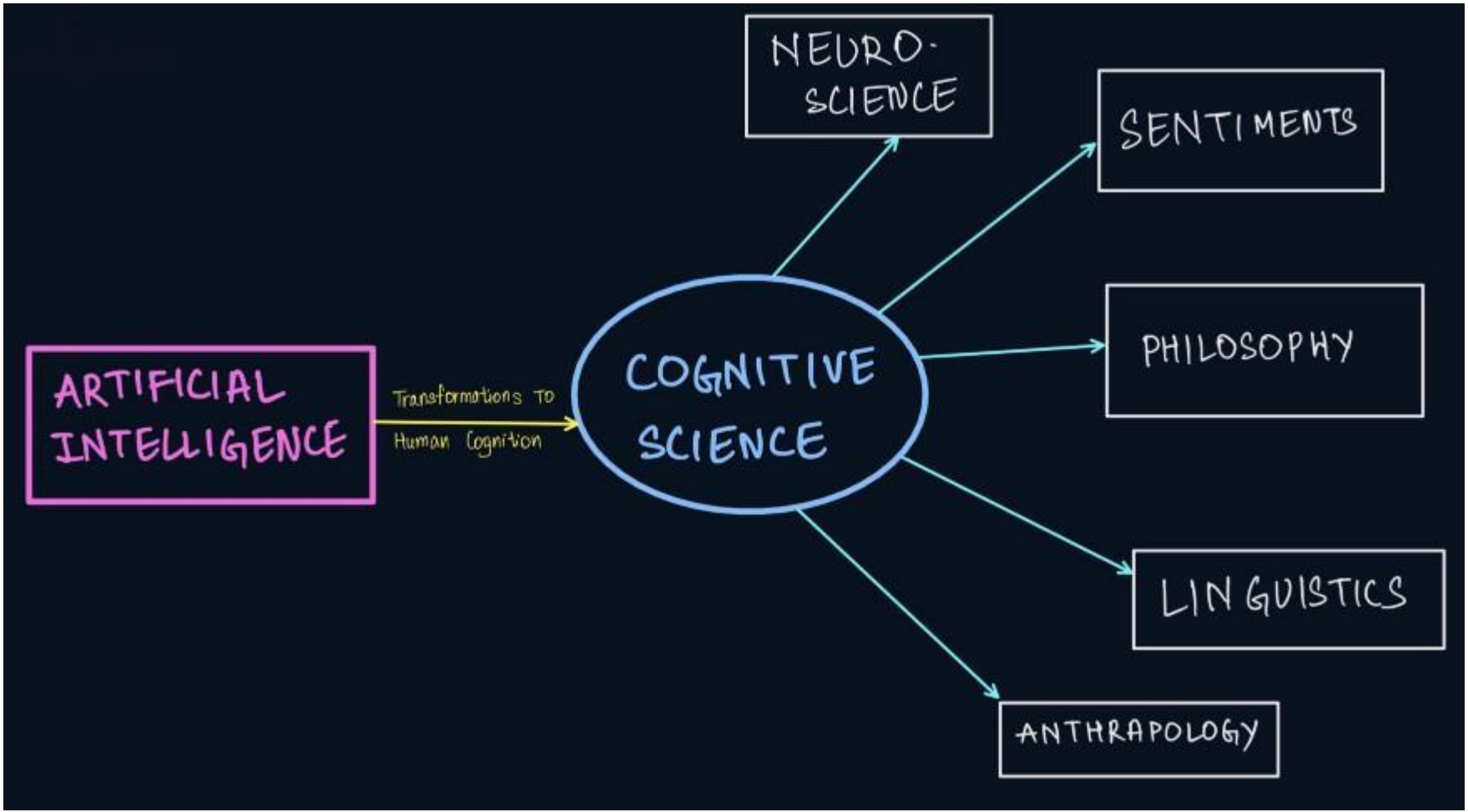
Artificial Intelligence today has reached heights and lengths that were not imagined a few years back. Programs and computer systems can now mimic human behavior, reactions, and responses to a high level of accuracy.

Sentiment Analysis

The analysis of human sentiments, which is also referred to as mining of opinions or Emotion AI in circumstances, is the study of different states of the human brain. Factors that are responsible for making sentiment analysis possible are natural language processing, computational linguistics, text mining, and analysis of biometrics.

The basic task of any sentiment analysis program is to isolate the polarity of the input (text, speech, facial expression, etc.) to understand whether the primary sentiment presented is positive, negative, or neutral. Based on this initial analysis, programs then often dig deeper to identify emotions like enjoyment, happiness, disgust, anger, fear, and surprise.
There are two precursors to this analysis. One is the quantifying of the input data for algorithms to read and process, secondly, it's the psychological research that helps in identifying which expression stands for what emotion.

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Cognitive Science

In terms of computing systems, cognitive science is the study of scientific processes that occur in the human brain. It is responsible for examining the functions of cognition, namely, perception of thoughts, languages, memory of the brain, reasoning, and processing received information. At a broader level, it is the study of intelligence and behavior.

The goal of Cognitive Science is to study the human brain and understand its principles of intelligence. This is done with the hope that by building computer systems from the knowledge of human intelligence, machines will be able to mimic learning and develop intelligent behavior patterns like humans.

Cognitive Science operates in three distinct levels of analysis:

The computational theory: At this level, the goals of the analysis are specified and fed to the computer system. This could be an imitation of speech or an understanding of emotions.

Representation and algorithms: In general Machine Learning terms, this is the training stage. Here the ideal input and output scenarios are presented to the machine and algorithms are put in place that will ultimately be responsible for transforming input to output.

The hardware implementation: This is the final cognition phase. It is the enactment of the algorithm in the real world and analysis of its working trajectory against a human brain.

Face Emotion Recognizer

The Face Emotion Recognizer (generally knowns as the FER) is an open-source Python library built and is used for sentiment analysis of images and videos. The project is built on a version that uses a convolution neural network with weights mentioned in the HDF5 data file present in the source code (The execution of FER can be found here) of this system's creation model. This can be overridden by using the FER constructor when the model is called and initiated.
MTCNN (multi cascade convolutional network) is a parameter of the constructor. It is a technique to detect faces. When it is set to 'True' the MTCNN model is used to detect faces, and when it is set to 'False' the function uses the default OpenCV Haarcascade classifier.
detect_emotions(): This function is used to classify the detection of emotion and it registers the output into six categories, namely, 'fear', 'neutral', 'happy', 'sad', 'anger', and 'disgust'. Every emotion is calculated, and the output is put on a scale of 0 to 1.
The flow of Logic: The program starts by taking into input the image or video that needs analysis. The FER() constructor is initialized by giving it a face detection classifier (either Open CV Haarcascade or MTCNN). We then call this constructor's detect emotions function by passing the input object (image or video) to it. The result achieved is an array of emotions with a value mentioned against each. Finally, the *'top_emotion'* function can seclude the highest valued emotion of the object and return it.

Output

The code individually takes images as input and details out various emotions and their separate intensity levels in the output. Using top_emotion() we then extract the most dominant sentiment of the image.

Emotions- Angry: 0.01, Disgust: 0.0
Fear: 0.0, Happy: 0.01, Sad: 0.01,
Surprised: 0.0, Neutral: 0.97
Dominant Emotion: Neutral

Emotions- Angry: 0.0, Disgust: 0.0
Fear: 0.0, Happy: 0.58, Sad: 0.02,
Surprised: 0.0, Neutral: 0.40
Dominant Emotion: Happy

Emotions- Angry: 0.0, Disgust: 0.0
Fear: 0.0, Happy: 0.98, Sad: 0.0,
Surprised: 0.0, Neutral: 0.01
Dominant Emotion: Happy

Emotions- Angry: 0.78, Disgust: 0.0
Fear: 0.14, Happy: 0.0, Sad: 0.03,
Surprised: 0.01, Neutral: 0.04
Dominant Emotion: Angry

Conclusion

Sentiment Analysis and Face Detection, individually have numerous use-cases in today's world. We see object detectio n algorithms in public parking lots, traffic monitoring systems, etc. that take images of people driving vehicles to keep re cords. Sentiment Analysis is furthermore used in therapy where physical meetings of the therapist and their patient are not possible. The study of human cognition has also evolved medicines. On the technological front, virtual assistants, pr ofile evaluation assistants, and automation bots are built to mimic the actions of humans and replace them with the hop e of increasing accuracy and decreasing errors. It is therefore a very important part of the Artificial Intelligence inspired world we live in today. A more engrossing and complicated approach to computer vision is by using cloud-based algorit hms like Azure Cognitive Services or Deep Learning mechanisms, which we have not covered in this story, but could c ome in handy for complex scenarios.