

Chapter 10

Explainable Artificial Intelligence (XAI) for Emotion Detection

Madan Mohan Tito Ayyalasomayajula

 <https://orcid.org/0009-0004-6873-6716>

Aspen University, USA

Sailaja Ayyalasomayajula

 <https://orcid.org/0009-0001-4835-4284>

Aspen University, USA

Jay Kumar Pandey

 <https://orcid.org/0000-0003-4086-5730>

Shri Ramswaroop Memorial University, India

ABSTRACT

This chapter delves into the significance of explainable artificial intelligence (XAI) in emotion detection (ED) systems, which aim to provide transparency and interpretability in affective computing. The chapter introduces ED systems, defining their purpose and importance in various industries. Subsequently, the need for XAI in emotion detection is discussed, emphasizing ethical concerns, legal requirements, and user trust. Next, the fundamentals of ED systems are explored, encompassing techniques for emotion recognition via facial expressions, voice tones, and text. The challenges associated with these techniques, including variability in human expressions, cultural differences, and data scarcity, are addressed. Next, explanation methods for ED models, and the popular XAI frameworks are presented and evaluated. Quantitative and qualitative evaluation metrics are employed to assess the effectiveness of XAI in ED. Lastly, three case studies demonstrate the successful application of XAI, and as research evolves, future directions that include advanced explainable ED are discussed.

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INTRODUCTION

Emotion detection systems, often called affective computing or emotion identification systems, are an intriguing combination of artificial intelligence (AI), psychology, and multimedia technologies. These systems attempt to interpret and categorize human emotions by examining a variety of inputs such as facial expressions, vocal inflections, and text content. Understanding human emotions is necessary for successful human-computer interaction (HCI) (Deshmukh et al., 2017). Machines can become more comprehensible and user-friendly if they detect and respond to our emotional states. This technology has sparked great interest due to its potential uses in various industries.

AI and machine learning are central to emotion recognition. These algorithms are taught using enormous databases of human faces, vocals, and text, each precisely annotated with the appropriate emotion. They use complex algorithms to discover patterns in the data points that correspond to specific emotions such as happiness, sadness, rage, and surprise. The most effective systems incorporate several inputs beyond a single data source. Facial recognition technology detects emotional indicators by tracking movements in the brows, eyes, and lips (Mehta et al., 2019). Vocal analysis uses speech patterns like frequency, pitch, and loudness to determine emotional states. Furthermore, natural language processing (NLP) tools examine written material, assessing sentiment and underlying emotions. Some advanced systems are even pushing the envelope by analyzing physiological indicators like heart rate and conductivity of the skin to acquire a more comprehensive knowledge of emotional states.

However, this robust technology does not come without its obstacles and limitations. The development of emotion recognition raises concerns about emotional labor in the workplace, with some fearing that it would increase pressure on employees to always portray good feelings. There are also worries regarding potential biases and the importance of transparency, especially as researchers study emotion recognition in lie detection technologies.

Overview of Emotion Detection Systems

Definition and Importance

Artificial intelligence (AI), psychology, and multimedia technologies are all areas explored by emotion detection systems, often referred to as affective computing or emotion identification systems. The purpose of these systems is to automatically recognize and classify human emotions based on the cues that can be observed. These artificial intelligence researchers typically engage in combat with individuals based

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