Using Machine Learning for Facial Emotion Expressiveness Rating of Actors

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Theatre is a dynamic form of communication designed for both cultural expression and entertainment. Through a combination of voice, movement, and expression, actors work towards bringing stories to life, aiming to communicate the story to the audience and evoke emotional reactions from it. While the overall emotional tone of a production is guided by the director, it is the actors' portrayals that are in direct connection with viewers. By using facial expressions, gestures, body movements, vocal intonations, but also costumes and masks, actors aim to bring out the emotions of their characters, allowing the audience to experience these emotions on a personal level. Recent advances in emotion recognition algorithms [29] offer new possibilities, can bridge the gap between theatrical expressiveness and interactive digital narratives, such as games, and can be applied to enhance character design by creating more nuanced and believable digital characters.

In this work, we aim to investigate the applicability of state-of-the-art computer vision and machine learning approaches to detect and rate actors' facial expressiveness with respect to certain target emotions. Current advances in affective computing [1] have tried to automatically detect and categorise human facial expressions –a task typically referred to as Facial Emotion Recognition (FER) [6, 7, 13]– but this is the first approach to (i) *apply these techniques in a theatrical context* and (ii) *rate how well the actors deliver these emotional expressions*. Our long-term vision is to create a gamified environment in the context of [5, 3, 23], where young actors, with the help of technology, can improve on how to control their facial expressions, convey their feelings to the audience and ultimately

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improve their acting.

FER uses AI to analyze and classify human facial expressions into emotional categories such as happiness, sadness, anger, and surprise [6, 7, 13]. While FER is commonly applied in fields like education [20, 9, 24] and healthcare [15, 11, 4], its use in theatrical acting is practically unexplored as also acknowledged in [18]. Few attempts to apply affective computing in a theatrical context focus mainly in audience engagement [18, 19], while other lines of work focus on speech [16, 17] and body movements [25] rather than facial features/expressions.

In theatre, where emotional delivery is key to engaging the audience, the ability to detect and rate emotions can offer actors valuable feedback. Our work investigates how FER can assess expressiveness in a theatrical context, allowing actors to refine their emotional delivery. Rather than merely detecting emotions, we aim to rate how well actors convey specific feelings using their facial expressions, offering more detailed insights into performance quality. To do so, we utilize state-of-the-art deep learning algorithms [27, 26] that analyze an actor's facial expressions in real time. The system classifies these expressions into emotional categories and provides a rating based on criteria such as accuracy, intensity, and expressiveness.

Our approach integrates (i) *Emotion Detection:* identifying and classifying facial ex pressions into distinct emotions, (ii) *Emotion Rating:* assessing the quality/intensity of these emotions and offering detailed feedback on performance, (iii) *Application in Digital Character Design:* FER insights can be applied to improve the emotional expressiveness of digital avatars in video games, and (iv) *Gamified Training:* creating a training tool where actors can practice and improve their emotional expressiveness through real-time feedback. We currently use a pre-trained model on standardised FER corpora [10, 2, 30, 8, 21, 22, 14] that includes varying image resolutions and contains faces of different ages, genders, and races. However, we plan to extend this model by training it with (i) faces wearing masks of different types [12], (ii) actor facial expressions cropped from video/movie streams [28] and (iii) expressions from actors-in-training (e.g., students in performing acts classes).

In conclusion, FER offers a promising new tool for actors to refine their emotional performances. By analysing and rating emotional expressiveness, this technology will provide feedback that can be used in training environments and applied to digital charac ter design. As AI continues to evolve, FER has the potential to transform both traditional theatre and interactive digital storytelling, creating deeper emotional connections between performers and their audiences. In the domain of game studies, FER can significantly en hance the emotional depth and realism of digital characters. By integrating FER insights, game developers will be able to create more nuanced and believable avatars, which will respond dynamically to player interactions, enrich the player's immersion, and open new avenues for storytelling in games. Finally, incorporating ML-driven feedback mechanisms into game design will provide real-time emotional responses, fostering a more interactive and emotionally resonant gameplay environment.

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