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Deep Learning-Based Facial Expression Recognition

Presented by:

Laidi Chaima
Tebtoube Aya

Supervised by:

Dr.Ayeche farid

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الملخص

تُعتبر تعابير الوجه من أهم وسائل التواصل غير اللفظي، وهي تلعب دورًا أساسيًا في فهم مشاعر الإنسان. يهدف هذا البحث إلى تطوير نظام للتعرف التلقائي على تعابير الوجه باستخدام تقنيات التعلم العميق ونقل التعلم.

تُظهر النتائج أن استخدام الشبكات العصبية الالتفافية والنماذج المدربة مسبقًا مثل AlexNet وVGG يحسن بشكل كبير من دقة التعرف ويقلل من وقت التدريب وGoogleNet.

{الكلمات المفتاحية:} التعرف على تعابير الوجه، التعلم العميق، الشبكات العصبية الالتفافية، نقل التعلم، الذكاء الاصطناعي.

ABSTRACT

Facial Expression Recognition is a deal in computer vision and emotional intelligence. It helps computers understand how humans feel and interact with them in a natural way.

Traditional methods have trouble working outside of labs but deep learning can help computers understand human emotions from videos and pictures.

This research is about creating Facial Expression Recognition systems using the latest deep learning techniques and transfer learning.

It aims to make computers better, at understanding emotions. This thesis is a study of Facial Expression Recognition using Deep Learning and Transfer Learning. It starts by explaining the basics of Facial Expression Recognition, including how emotionsre represented, how machines process facial expressions and how traditional machine learning methods work.

Then it looks at learning, including neural networks and convolutional neural networks. It also looks at transfer learning, which's a way to adapt pre-trained models to new jobs.

Several pre-trained models, including AlexNet, VGG and GoogleNet are tested to see how well they can recognize expressions. The results show that transfer learning is really good, at making recognition while making training easier and faster. Finally The findings suggest that deep learning can be used to make Facial Expression Recognition systems that work in real life.

Keywords: Facial Expression Recognition, Deep Learning Transfer Learning, Convolutional Neural Networks, AlexNet, VGG,GoogleNet, Artificial Intelligence, Emotion Recognition.

RÉSUMÉ

Les expressions faciales constituent l'un des moyens les plus importants de la communication non verbale et jouent un rôle essentiel dans la compréhension des émotions humaines. La reconnaissance automatique des expressions faciales (Facial Expression Recognition – FER) est devenue un domaine de recherche majeur en vision par ordinateur et en intelligence artificielle en raison de ses nombreuses applications dans l'interaction homme-machine, la santé, l'éducation, la sécurité et les systèmes intelligents.

Cependant, la reconnaissance fiable des émotions reste une tâche complexe en raison des variations d'éclairage, des changements de pose de la tête, des occlusions et de la diversité des visages humains. Les méthodes traditionnelles basées sur des caractéristiques conçues manuellement montrent des performances limitées dans les environnements réels. Afin de surmonter ces limitations, les techniques de Deep Learning, notamment les réseaux de neurones convolutifs (CNN), ont démontré une grande capacité à extraire automatiquement des caractéristiques pertinentes à partir des images faciales.

Les résultats expérimentaux montrent que l'apprentissage par transfert permet d'améliorer significativement les performances du modèle tout en réduisant le temps d'entraînement et la quantité de données nécessaires. Cette étude met en évidence l'efficacité des réseaux de neurones convolutifs préentraînés pour la reconnaissance automatique des émotions et confirme leur potentiel pour le développement de systèmes intelligents capables d'interagir de manière plus naturelle avec les utilisateurs.

Mots clés: Reconnaissance des expressions faciales, FER, Deep Learning, Transfer Learning, CNN, AlexNet, VGG, GoogleNet, Intelligence artificielle, Reconnaissance des émotions.

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