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Recent Trends in Image Processing and Pattern Recognition

5th International Conference, RTIP2R 2022, Kingsville, TX, USA, December 1-2, 2022, Revised Selected Papers

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About this book

This book constitutes the refereed proceedings of the 5th International Conference on Recent Trends in Image Processing and Pattern Recognition, RTIP2R 2022, held in Kingsville, TX, USA, in collaboration with the Applied AI Research Laboratory of the University of South Dakota, during December 01-02, 2022.

The 31 full papers included in this book were carefully reviewed and selected from 69 submissions. They were organized in topical sections as follows: healthcare: medical imaging and informatics; computer vision and pattern recognition; internet of things and security; and signal processing and machine learning.

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Keywords

[artificial intelligence](#) [classification methods](#) [computer security](#)
[computer vision](#) [correlation analysis](#) [cryptography](#) [databases](#)

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A Deep Learning-Powered Voice-Enabled Math Tutor for Kids

[Arnab Banerjee](#)  [Srijoy Paul](#), [Tisu Priya](#), [Anamika Rohit](#) & [Nibaran Das](#)

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Abstract

In this study, a voice enabled math tutor system is proposed that enables children to practice math problems on their own. For this, we have developed numerical sound dataset targeting the application. In the application, when the system is turned on, a math problem is generated, and the child will respond verbally to it. The system will categorize the audio data (user-provided answer) and produce a text number, which will then be further analysed and generate output as either a correct or erroneous answer. Any toy can be equipped with the proposed system, allowing a kid to practice problems while engaging with the system. A dataset named JUDVLP-BCRP: numeralSound.v1 is prepared, with 2315 audio data of numerals in the range of 0 to 9. In a typical setting, the audio data were collected from people in the age range of 10 to 60 from West Bengal, Jharkhand, Delhi, Assam, Bihar, and Orissa. After pre-processing the audios, Mel spectrograms were produced which acts as input by the deep neural network algorithms. The audio data has been classified using a number of well-known

deep learning algorithms, including DenseNet-121, VGG-16, modified DenseNet121 (DenseNet-41), and modified VGG-16 (VGG-12). Using DenseNet-121, VGG-16, DenseNet-41, VGG-12, 94.60%, 98.70%, 98.27%, and 98.48% accuracy was obtained. The networks were run for 100 epochs using a learning rate of 0.0001, and categorical cross-entropy loss function. The VGG-16 produced the highest precision of 98.9%, and the VGG-12 produced the second-best precision of 98.6%. The outcomes are positive and influence a workable system design.

Keywords

[Sound classification](#) [Deep learning](#) [Math tutor](#) [Numeral sound classification](#)
[Voice enabled](#)

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