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Section Information

The section of Optics and Lasers is open to receive high-quality papers reporting state-of-the-art technology in the fields of optics and lasers, which includes non-linear optics such as high-order harmonics, Raman, wave-mixing, multiphoton ionization, as well as other basic phenomena in this field. The section welcomes rudimentary and challenging studies concerning optical devices, such as photonic crystal fibers and micro-scale optics for fabrication of novel optical systems. Needless to say, production of lasers with unique properties, such as a high-power fiber laser or facilitating a large-scale laser system, are of great importance in this section. By contrast, studies focusing on data analyses methods or simulation based on traditional techniques should be sent to a different specialized journal.

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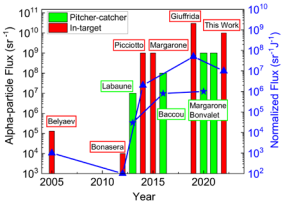
Featured Papers

DOI:10.3390/app12031444

In-Target Proton–Boron Nuclear Fusion Using a PW-Class Laser

Authors: Daniele Margarone, Julien Bonvalet, Lorenzo Giuffrida, Alessio Morace, Vasiliki Kantarelou, Marco Tosca, Didier Raffestin, Philippe Nicolai, Antonino Picciotto, Yuki Abe, Yasunobu Arikawa, Shinsuke Fujioka, Yuji Fukuda, Yasuhiro Kuramitsu, Hideaki Habara and Dimitri Batani

Abstract: Nuclear reactions between protons and boron-11 nuclei (p–B fusion) that were used to yield energetic α-particles were initiated in a plasma that was generated by the interaction between a PW-class laser operating at relativistic intensities (~3 × 10^{19} W/cm^2) and a 0.2-mm thick boron nitride (BN) target. A high p–B fusion reaction rate and hence, a large α-particle flux was generated and measured, thanks to a proton stream accelerated at the target's front surface. This was the first proof of principle experiment to demonstrate the efficient generation of α-particles (~10^{10}/sr) through p–B fusion reactions using a PW-class laser in the "in-target" geometry.

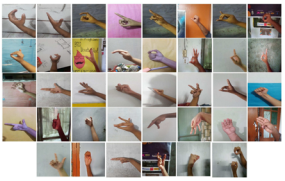


DOI:10.3390/app12083933

BenSignNet: Bengali Sign Language Alphabet Recognition Using Concatenated Segmentation and Convolutional Neural Network

Authors: Abu Saleh Musa Miah, Jungpil Shin, Md Al Mehedi Hasan and Md Abdur Rahim

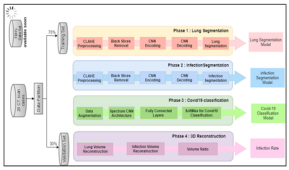
Abstract: Sign language recognition is one of the most challenging applications in machine learning and human-computer interaction. Many researchers have developed classification models for different sign languages such as English, Arabic, Japanese, and Bengali; however, no significant research has been done on the general-shape performance for different datasets. Most research work has achieved satisfactory performance with a small dataset. These models may fail to replicate the same performance for evaluating different and larger datasets. In this context, this paper proposes a novel method for recognizing Bengali sign language (BSL) alphabets to overcome the issue of generalization. The proposed method has been evaluated with three benchmark datasets such as '38 BdSL', 'KU-BdSL', and 'Ishara-Lipi'. Here, three steps are followed to achieve the goal: segmentation, augmentation, and Convolutional neural network (CNN) based classification. Firstly, a concatenated segmentation approach with YCbCr, HSV and watershed algorithm was designed to accurately identify gesture signs. Secondly, seven image augmentation techniques are selected to increase the training data size without changing the semantic meaning. Finally, the CNN-based model called BenSignNet was applied to extract the features and classify purposes. The performance accuracy of the model achieved 94.00%, 99.60%, and 99.60% for the BdSL Alphabet, KU-BdSL, and Ishara-Lipi datasets, respectively. Experimental findings confirmed that our proposed method achieved a higher recognition rate than the conventional ones and accomplished a generalization property in all datasets for the BSL domain.



DOI:10.3390/app12104825

A Deep Learning-Based Diagnosis System for COVID-19 Detection and Pneumonia Screening Using CT Imaging

Authors: Ramzi Mahmoudi, Narjes Benameur, Rania Mabrouk, Mazin Abed Mohammed, Begonya Garcia-Zapirain and Mohamed Hedi Bedoui

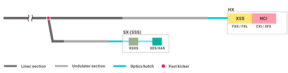


Abstract: *Background:* Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) is a global threat impacting the lives of millions of people worldwide. Automated detection of lung infections from Computed Tomography scans represents an excellent alternative; however, segmenting infected regions from CT slices encounters many challenges. *Objective:* Developing a diagnosis system based on deep learning techniques to detect and quantify COVID-19 infection and pneumonia screening using CT imaging. *Method:* Contrast Limited Adaptive Histogram Equalization pre-processing method was used to remove the noise and intensity in homogeneity. Black slices were also removed to crop only the region of interest containing the lungs. A U-net architecture, based on CNN encoder and CNN decoder approaches, is then introduced for a fast and precise image segmentation to obtain the lung and infection segmentation models. For better estimation of skill on unseen data, a fourfold cross-validation as a resampling procedure has been used. A three-layered CNN architecture, with additional fully connected layers followed by a Softmax layer, was used for classification. Lung and infection volumes have been reconstructed to allow volume ratio computing and obtain infection rate. *Results:* Starting with the 20 CT scan cases, data has been divided into 70% for the training dataset and 30% for the validation dataset. Experimental results demonstrated that the proposed system achieves a dice score of 0.98 and 0.91 for the lung and infection segmentation tasks, respectively, and an accuracy of 0.98 for the classification task. *Conclusions:* The proposed workflow aimed at obtaining good performances for the different system's components, and at the same time, dealing with reduced datasets used for training.

DOI:10.3390/app12031010

Recent Progress of the PAL-XFEL

Authors: Intae Eom, Sae Hwan Chun, Jae Hyuk Lee, Daewoong Nam, Rory Ma, Jaehyun Park, Sehan Park, Sang Han Park, Haeryong Yang, Inhyuk Nam, Myung Hoon Cho, Chi Hyun Shim, Gyujin Kim, Chang-Ki Min, Hoon Heo, Heung-Sik Kang and Changbum Kim



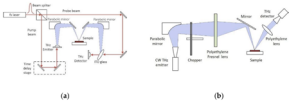
Abstract: The X-ray free-electron laser of the Pohang Accelerator Laboratory (PAL-XFEL) was opened to users in 2017. Since then, significant progress has been made in PAL-XFEL operation and beamline experiments. This includes increasing the FEL pulse energy, increasing the FEL photon energy, generating self-seeding FEL, and trials of two-color operation. In the beamline, new instruments or endstations have been added or are being prepared. Overall, beamline operation has been stabilized since its initiation, which has enabled excellent scientific results through efficient user experiments. In this paper, we describe details of the recent progress of the PAL-XFEL.

DOI:10.3390/app12083822

An Overview of Terahertz Imaging with Resonant Tunneling Diodes

Authors: Jue Wang, Mira Naftaly and Edward Wasige

Abstract: Terahertz (THz) imaging is a rapidly growing application motivated by industrial demands including harmless (non-ionizing) security imaging, multilayer paint quality control within the automotive industry, insulating foam non-invasive testing in aerospace, and biomedical diagnostics. One of the key components in the imaging system is the source and detector. This paper gives a brief overview of room temperature THz transceiver technology for imaging applications based on the emerging resonant tunneling diode (RTD) devices. The reported results demonstrate that RTD technology is a very promising candidate to realize compact, low-cost THz imaging systems.



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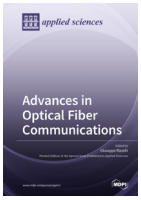

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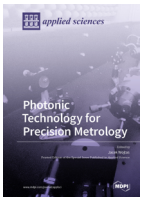

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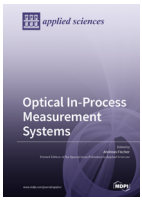

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