



तेजपुर विश्वविद्यालय
(केंद्रीय विश्वविद्यालय)

नपाम, तेजपुर - 784 028, असम, भारत

TEZPUR UNIVERSITY

(A Central University)

Napaam, Tezpur - 784 028, Assam, India

(सर्वोत्तम विश्वविद्यालय के लिए कुलाध्यक्ष पुरस्कार, 2016, भारत के 100 श्रेष्ठ उच्च शिक्षण संस्थानों में पंचम स्थान और 'नाक' द्वारा 'ए' ग्रेड प्राप्त विश्वविद्यालय)
(Awardee of Visitor's Best University Award, 2016, 5th among India's Top 100 Universities, MHRD-NIRF Ranking, 2016 and NAAC Accredited with "A" Grade)

A REPORT ON
*Joint PhD Programme between Queen's University Belfast (QUB) and
Tezpur University (TU)*

1. Name of the Collaborative Activity: Joint PhD Programme between Queen's University Belfast (QUB) and Tezpur University (TU)
2. Nature of Activity: PhD Co-supervisor
3. Name of the Collaborating Agency/ Individual with affiliation, and contact details:
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4. Summary of collaboration:
Millimeter-waves (mmW) can penetrate through materials that are opaque at optical wavelengths, yet they are non-ionizing and thus harmless to living tissue at low power levels. Hence, mmW imaging is of considerable interest for security screening, remote sensing, biomedical imaging, and many other applications. Imaging at mmW frequencies exhibits a fundamental resolution limit determined by the finite size aperture of the imaging system, known as the diffraction-limited resolution. For medical applications where high spatial resolution is required, several techniques can be adopted, including increasing the frequency band of operation, increasing the aperture size, and reducing the imaging distance. Despite improving the resolution, these techniques bring certain challenges, such as increased hardware complexity, increase in the overall size of the aperture, large datasets for processing, and reduced operating range for applications requiring large distances, such as standoff detection. An alternative solution to these challenges is super-resolution that can be achieved on the signal processing layer using techniques such as DCT/wavelet transform and machine learning. Current research in this project investigates super-resolution techniques in mmW compressive computational imaging. The proposed super-resolution algorithm will have the capability of improving the resolutions of any mmW reconstructions. The Improved resolution of the imaging system will be the key to achieving the identification of objects from low-resolution reconstructions. The object identification from the reconstructions is carried out using a CNN algorithm. Processing of the mmW reconstructed images is performed using parallel-computing tools, facilitating super-resolution and classification in real-time.



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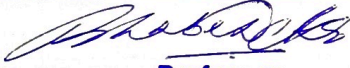

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5. List of year-wise activities under the collaboration:

Joint Publications (2021-22):

- Rahul Sharma, Raphael Hussung, Andreas Keil, Fabian Friederich, Thomas Fromenteze, Mohsen Khalily, Bhabesh Deka, Vincent F. Fusco and Okan Yurduseven, Coded-Aperture Computational Millimeter-wave Image Classifier using Convolutional Neural Network, IEEE Access, 2021.
- Rahul Sharma, Okan Yurduseven, Bhabesh Deka, and Vincent Fusco, Hardware Enabled Acceleration of Near-Field Coded Aperture Radar Physical Model for Millimetre-Wave Computational Imaging, Progress In Electromagnetics Research B, vol. 90, pp. 91-108, 2021.
- Rahul Sharma, Okan Yurduseven, Bhabesh Deka, and Vincent Fusco, "Towards a convolutional neural network coupled millimetre-wave coded aperture image classifier system", SPIE Defense + Commercial Sensing 2021 conference, 2021.
- Rahul Sharma, Raphael Hussung, Andreas Keil, Fabian Friederich, Thomas Fromenteze, Mohsen Khalily, Bhabesh Deka, Vincent Fusco, Okan Yurduseven, Performance Analysis of Classification Algorithms for Millimeter-Wave Imaging, European Conference on Antennas and Propagation, Madrid, Spain, 2022.

6.

Signature of Faculty	Signature and Seal of Head of Department/ Centre/ Cell
 Professor Department of Electronic & Comm. Engg. Tezpur University Name: Prof. Bhabesh Deka Designation: Professor	 Head, Department of Electronics & Comm. Engg. Tezpur University Name: Prof. Santanu Sharma Designation: Professor & HoD, ECE