

REPORT

Report on participation of the ICMR International Fellow (ICMR-IF) in Training/Research abroad.

1. Name and designation of ICMR- IF : DR. MRINAL KANTI BHOWMIK
(SENIOR ICMR-DHR INTERNATIONAL FELLOW),
ASSISTANT PROFESSOR (STAGE-II),
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING,
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2. Address : TRIPURA UNIVERSITY (A CENTRAL UNIVERSITY),
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3. Frontline area of research in which training/research was carried out : **Area of the Proposed work:**
Medical Image Analysis (Biological Cell Imaging)
Title of the Proposed work:
Improved Cervical Cancer Screening for Low Resource Areas using
Cytopathological Images in relevance to Tripura.
4. Name & address of Professor and host institute : PROF. NIHARIKA NATH
DEPARTMENT OF BIOLOGICAL & CHEMICAL SCIENCES,
NEW YORK INSTITUTE OF TECHNOLOGY (NYIT),
1855 BROADWAY, NEW YORK, NY 10023, USA
5. Duration of fellowship with exact date : 26TH DECEMBER, 2019 to 25TH JANUARY, 2020 (One MONTH)
4. Highlights of work conducted :
 - i) **Technique/expertise acquired:**
 - A. **During visit at NYIT**, special lectures conducted by Biological & Chemical Sciences Department of New York Institute of Technology (NYIT) has been attended for understanding cancer cellular biology and multiscale modelling of cell shapes towards analysis of pap-smear cell images.
 - B. **During visit at NYIT**, extended analysis on our own created “AGMC-TU (Agartala Government Medical College – Tripura University) Pap-Smear Cytological Image Dataset” has been done. The dataset is created in collaboration with Department of Pathology, Agartala Government Medical College (AGMC) and Gobind Ballav Pant (GBP) Hospital, Government of Tripura [Dataset Details available in <http://mkbhowmik.in/AGMC-tuDb.aspx>]. The analysis of this dataset has been carried out through pre-processing and segmentation of nucleus region from holistic pap-smear images and classification of these pap-smear images through conventional & deep features using state-of-the-art classifiers.
 - ii) **Research results, including any papers, prepared/submitted for publication:**
 - A. The below mentioned research papers has been discussed with Prof. N. Nath related to cervical abnormality detection for enhancing and communicate them in well renowned **Journals/ Tier-I/ Tier-II/ Conferences:**
 - o **Paper 1:** Discriminative Features for Asymmetric Characterization and Classification Using Convolutional Neural Network of Pap-Smear Cells towards Early Detection of Cervical Cancer. *(This paper is based on the extended analysis of “AGMC-TU Pap-Smear Cytological Image Dataset” done during the visit at NYIT and is under preparation).*
 - o **Paper 2:** AGMC-TU Pap Smear Cytological Image Dataset: Its Creation and Analysis.
 - o **Paper 3:** A Comprehensive Survey on Cellular Imaging Modalities for Automatic Cervical Cancer Detection.
 - B. Discussion on the specific objectives and work plan of the project proposal has been done for initiating collaborative work with NYIT has been done:
 - o **Title of the Proposed Funded Project:** “Improved Early Cervical Cancer Screening/ Detection at Pre-Malignant Stage for Ethnic & Non-Ethnic Population of Low Resource Areas of Tripura using Diagnostic Multimodal Cell Imaging”.

The aforementioned project will be submitted under **Call for Proposals of various funding agencies of Government of India in collaboration with Agartala Government of Medical College (AGMC) and Gobind Ballav Pant (GBP) Hospital, Government of Tripura and New York Institute of technology (NYIT), USA**. This project will provide multimodality microscopic cytological imaging based computer aided decision support system for cervical abnormality detection at pre-cancerous stage. The microscopic cell imaging modalities to be used in the aforementioned project are Pap-smear images using light microscopic imaging and electron images using field emission scanning electron microscopic (FE-SEM) imaging. The field emission scanning electron microscopic (FE-SEM) is already available in Central Instrumentation Center of Tripura University (A Central University).

iii) **Proposed utilization of the experience in India:**

A. **Human Resource Development in North Eastern (NE) Region of India:**

As the applicant is trying to prepare a team for the development and exploration of Human Resource in the North Eastern (NE) region of India, establishment of interdisciplinary collaboration between Computer Science and Engineering Department of Tripura University (A Central University) and Biological & Chemical Sciences Department of New York Institute of Technology (NYIT), New York will provide a platform for his vision.

- The **updated information and knowledge gathered from special lectures** conducted by Biological & Chemical Sciences Department of New York Institute of Technology (NYIT) **will be disseminated among the research scholars who are already pursuing Ph.D. as well as on the ongoing projects** in the relevant areas to find advanced ways for technology development.
- The collaboration will move forward by **bringing up researchers of the two nations to contribute their ideas in this relevant field**. A discussion on **joint supervision of M. Tech/ M.S. thesis has been conducted** and Prof. Niharika Nath has given her kind consent for providing expert guidance as a co-supervisor in respective M. Tech thesis. Also **joint supervision of Master's thesis in Biological & Chemical Sciences Department of New York Institute of Technology (NYIT) has already been initiated with Prof. Niharika Nath** in the domain of Biological Cell Imaging.
- The collaboration will also move forward in the **form of joint supervision of Ph.D and Post-Doctoral programme of University**. Travel of Tripura University students for Ph.D. or Post-Doctoral level and faculty travel to USA will promote understanding of the needs of a remote area low resource regions in the cooperation process.

B. **Mutuality and Complementarity:**

- The collaboration will be carried forward by **joint publication of the research papers** and patents in the domain of biological cell imaging between Tripura University (A Central University) and New York Institute of Technology (NYIT).
- The collaboration will be carried forward by **jointly organizing research oriented conferences/ workshops/ seminars in India and USA** and inviting eminent researchers in the relevant field as an expert speaker. A proposal for conducting workshop in the topic of **"Biological Cell Imaging for Diagnosis and Early Prediction of Cancer"** has already been submitted under **Ministry of Human Resource Development (MHRD) Scheme on Global Initiative on Academic Network (GIAN) of Government of India**. The submitted proposal is under review of the selection committee and Prof. Niharika Nath is a Foreign Faculty and Resource Person of the aforementioned proposal. These will be very much beneficiary for future researchers as well as development of human resource of NE India, and extremely beneficiary for hilly and remote NE state like Tripura.
- Furthering bilateral cooperation in cross-disciplinary research areas involving image and signal processing will be carried out by **submitting a collaborating research projects between Tripura University (A Central University) as a Parent Institute and New York Institute of Technology (NYIT) as a Collaborating Institute**. A **joint proposal** has already been submitted under the framework of Indo-US Virtual Networked Center of Biological Cell Imaging. The proposal has been submitted in collaboration with Biological & Chemical Sciences Department of New York Institute of Technology (NYIT). Collaborations will benefit long term by planning the establishment of a

'Consortium' with current organizations and NYIT, and build up with additional partners from developed regions and other remote areas of India.

Signature of ICMR-IF

Mrinal Kanti Bhowmik

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31.01.2020

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