

Professor Nikhil R. Pal, Ph. D.,
FNASc, FNAE, FNA, FIFSA, FIEEE, FTWAS
President, *IEEE Computational Intelligence Society*
Head, Center for Artificial Intelligence and Machine
Learning



Electronics & Communication Sciences Unit
Indian Statistical Institute
203 B. T. Road
Calcutta 700 108 INDIA
Tel +91 33 2575 2906 (w)
+91 33 2544 4365 (r)
+91 9433905237 (m)
Fax +91 33 2577 3035
Email nikhil@isical.ac.in

March 6, 2019

To Whom It May Concern

Mr. Shivam Tripathi, a third year B. Tech. student in Computer Science and Engineering at the *Pranveer Singh Institute of Technology*, Kanpur joined me for training during the period 9 January 2019 - 6 March 2019. To my understanding, Shivam came here with practically no knowledge of pattern recognition and machine learning. I asked him to work on a difficult problem, manifold learning for data visualization. With a very little guidance and supervision, Shivam was able to pick up the required knowledge to implement the t-Distributed Stochastic Neighborhood Embedding (t-SNE) algorithm as well as to try a few variants of the same to address some of the problems of t-SNE. In addition to this, he has implemented several auto-encoder based manifold learning algorithms. He has also experimented with a few modifications. A unique aspect of Shivam is that he capable of studying research papers of his own to go deep into the problems addressed therein. Whenever I had suggested some modifications/extensions, I really needed minimal effort to explain him what I wanted him to do. He wants to continue the investigation that we have started.

Based on my interaction, I found him to be an intelligent student who is strongly motivated to research work. He is very sincere and dedicated. He has an analytical mind, capable of logical thinking, and has a good programming skill. He is always "hungry" to know more – he has read several research papers during this short period. I am highly satisfied with his performance.

Nikhil R. Pal