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Faculty Name  : Debasis Samanta
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+++++++++++++++ BTP-1 Project Title +++++++++++++++
Product Ranking with Sentiment Analysis of Consumers


+++++++++++++++ BTP-1 Project Summary +++++++++++++++
This project will investigate the ranking of products available in the market gi
ven an item of interest of a user. The project is in the field of data analytics
, and data will be crawled from online portal like Amazon, Flipkart, etc. Basic
concept of ML/ DL and NLP is required.


+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++
None.

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+++++++++++++++ BTP-2 Project Title +++++++++++++++
Multiparty Authentication


+++++++++++++++ BTP-2 Project Summary +++++++++++++++
A single party authentication is common in almost all applications in single use
r as well as distributed environment. But, there are requirements, where more th
an one users need to be authenticated in order to grant an access to a secured s
ystem. This project will explore a methodology to achieve the multiparty authent
ication using biometric data of the stakeholders.


+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++
Needs good programming skill for this project.

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+++++++++++++++ BTP-3 Project Title +++++++++++++++
EEG Signal Classification using Graph Connectivity Analysis


+++++++++++++++ BTP-3 Project Summary +++++++++++++++
EEG (Electroencephalogram) is a popular BCI (Brain Computer Interface) hardware
and now in use in many applications, such as man-machine interaction, clinical p
ractice, automatic car driving, human reliability analysis, etc. EEG can capture
 brain signal of a user, which is in the form of a time series data and  it is h
igh-dimensional and high-volume data. Processing such data needs enough computat
ional intelligence which includes ML/ DL techniques. In this project, we shall t
ry to obtain an intermediate representation of EEG data in the form brain connec
tivity graph, which then can be processed using ML/ DL techniques to decide data
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+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++
Good mathematical ability and programming skill, in particular ML/ DL algorithm
implementation, etc. are desirable.

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Faculty Name  : Shamik Sural
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+++++++++++++++ BTP-1 Project Title +++++++++++++++
Blockchain applications


+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Please contact me for details.


+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++


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+++++++++++++++ BTP-2 Project Title +++++++++++++++
Adversarial Machine Learning


+++++++++++++++ BTP-2 Project Summary +++++++++++++++
Please contact me for details.


+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++


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+++++++++++++++ BTP-3 Project Title +++++++++++++++
Attribute based Access Control - I


+++++++++++++++ BTP-3 Project Summary +++++++++++++++
Please contact me for details.


+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++


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+++++++++++++++ BTP-4 Project Title +++++++++++++++
IoT Security - I


+++++++++++++++ BTP-4 Project Summary +++++++++++++++
Please contact me for details.


+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++


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+++++++++++++++ BTP-5 Project Title +++++++++++++++
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IoT Security - II

+++++++++++++++ BTP-5 Project Summary +++++++++++++++
Please contact me for details.

+++++++++++++++ BTP-5 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-6 Project Title +++++++++++++++
Attribute based Access Control - II

+++++++++++++++ BTP-6 Project Summary +++++++++++++++
Please contact me for details.

+++++++++++++++ BTP-6 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Partha Bhowmick

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Computer Graphics 1

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
As per student's interest.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Computer Graphics 2

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
As per student's interest

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Computer Graphics 3

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
As per student's interest

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Sudeshna Kolay

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Implementation of Algorithms for Euclidean TSP

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Euclidean Travelling Salesman Problem (TSP) is a central problem in Computationa
l Geometry. Given a set of n points in the 2-D plane, the objective is to find a
 minimum length tour that covers all the points. This project will look into the
 implementation of subexponential algorithms for the problem.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Problems on Terrain Guarding and Art Gallery

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
These are very important guarding problems in Computational Geometry. Given a po
lygon or a polygonal chain, how many points (guard positions) can you select so
that the entire polygon/polygonal chain is guarded? First, we will try to implem
ent efficient algorithms for polygons or polygonal chains of shapes commonly fou
nd in the IIT campus - hostel and office buildings, portions of boundary walls.
Then we will look into the theoretical aspect of the problem, trying to generali
ze our implementation results to efficient algorithms for any arbitrary polygons
/chains.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Euclidean Steiner Tree

+++++++++++++++ BTP-3 Project Summary +++++++++++++++

Euclidean Steiner Tree is an important problem in Computational Geometry. Given a set of points in the 2-D plane, the aim is to find the minimum length network that connects all the points in the set. In this project, we will look at known algorithms for the problem and then try to implement more efficient algorithms or obtain tight lower bounds for the current best algorithm. Currently, no 2^O(n) algorithm is known for the problem, n being the number of points in the given set. The current best algorithm has running time 2^(nlog n).

++++++++++++++++ BTP-3 : Any Additional Note/Comments? ++++++++++++++++

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Faculty Name : Abir Das

++++++++++++++++ BTP-1 Project Title ++++++++++++++++
Video Domain Adaptation

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
Area of Research: Computer Vision Abstract: This project will deal with Video Domain Adaptation. It is not easy to get labeled videos of activities in many application areas or domains (target domain). However, it may be easy to get videos with labels in a different but related domain (source domain). The project will aim to transfer knowledge from the source domain and align the two domains so that label scarcity in the target domain does not hamper learning in this domain.

++++++++++++++++ BTP-1 : Any Additional Note/Comments? ++++++++++++++++
Familiarity of the student with domain adaptation and graph convolutional networks will be pluses for the project.

++++++++++++++++ BTP-2 Project Title ++++++++++++++++
Mitigating Bias in Captioning Models

++++++++++++++++ BTP-2 Project Summary ++++++++++++++++
Area of Research: Computer Vision Abstract: Consider a typical scenario of dataset bias. Most images of kitchen or cooking involve an woman. This bias might lead to incorrect perhaps offensive predictions and associate an woman to a kitchen scene even if the person present is a man. This project will try to mitigate bias by using a generative model producing more images corresponding to the typical minority in the dataset.

++++++++++++++++ BTP-2 : Any Additional Note/Comments? ++++++++++++++++
Familiarity of the student with image captioning deep models and dataset bias will be pluses for the project.

++++++++++++++++ BTP-3 Project Title ++++++++++++++++
Semi-Supervised Temporal Activity Detection

++++++++++++++++ BTP-3 Project Summary ++++++++++++++++
Area of Research: Computer Vision Abstract: The project will address scarcity of
 labeled data, especially in localizing activities in videos.

++++++++++++++++ BTP-3 : Any Additional Note/Comments? ++++++++++++++++
Familiarity of the student with activity recognition and semi-supervised learnin
g will be pluses for the project.

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Faculty Name : Soumyajit Dey

++++++++++++++++ BTP-1 Project Title ++++++++++++++++
A suitable RL algorithm to defend safety-critical cyber-physical systems against
 intelligent attacks :

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
The network component of a cyber-physical system (CPS) increases the opportunity
 for a cyber attacker. In most cases, the attack is stealthy and may lead to a l
ife-threatening situation for a safety-critical system. For example, drifting a
vehicle away from the intended trajectory by manipulating the driver's steering
inputs might cause a fatal accident. So, it is important to design a monitoring
and mitigation system that can detect such attack efforts. And to test how capab
le this designed monitoring system is, it is very important to model a challengi
ng attacker. But modeling such a fatal attack and detecting or mitigating them i
s tricky. Because it totally depends on the system dynamics and does not follow
any pattern or distribution. So, we utilize Reinforcement Learning (RL), to lear
n the vulnerabilities of a CPS and then detect and mitigate them. So in this pro
ject, we target to (i) develop a multi-agent RL framework using standard Python
 libraries to design such an attack detection and mitigation system for a safety
-critical CPS, and (ii) explore various RL algorithms and find the suitable one
which learns fast and provides a stable algorithm for this.

++++++++++++++++ BTP-1 : Any Additional Note/Comments? ++++++++++++++++

++++++++++++++++ BTP-2 Project Title ++++++++++++++++
A Learning-based attack detection system for automated connected vehicles

++++++++++++++++ BTP-2 Project Summary ++++++++++++++++
Automated connected vehicles (ACVs) are the future. In an intelligent transporta
tion system, ACVs make use of the transport network smartly to stay informed abo
ut their surroundings and move safely. But how vulnerable can it be? Consider a
group of connected vehicles driving cooperatively on a road and another ACV trie

s to join them, approaching from another road. Normally, ACVs communicate among themselves to ensure a safe merging. However, an attacker can sneak in and turn an ACV rogue, leading to a deadly accident. We intend to design a monitoring system to detect such attack efforts and a mitigation algorithm to unanimously neutralize it. Considering how unpredictable yet specialized the attack can be, to cripple a targeted ACV, we utilize Reinforcement learning(RL) so that we can intelligently learn the vulnerability of the connected system to model an attacker and limitations of an attacker to develop proper detection and mitigation strategy. In this project, we try to first set up a framework to model a connected vehicle scenario using traffic simulators like SUMO (Simulation of Urban Mobility), network simulators like OMNET++, and a system designer like Simulink. Then, we can integrate an intelligent (RL-based) attack detection and mitigation strategy, built using the python RL libraries, with such a set up to expose and disarm such attack efforts.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Learning based thermal-aware resource manager for real-time tasks

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
We all have faced the overheating issue on our mobile phones and observed how the performance degrades drastically. So imagine a car equipped with Advanced Driving Assistance System or worse a fully automated car, where much more complex computations than our mobile phone are running and such lag due to overheating in automotive platforms will result in catastrophic consequences. Such automotive platforms are usually embedded platforms packed with integrated CPU, GPU and other accelerators like DSP, NPU and the tasks running are real-time i.e. they need to finish execution within given deadlines. So, how do we utilise all these varying compute resources efficiently such that the problem of overheating is handled without hampering the deadlines? Moreover, applications running in such a system are highly dynamic, eg. pedestrian detection application will run more frequently in city road compared to a highway. So while designing a resource manager for such a dynamic system, how do we design learning-based techniques for efficient resource management? These are some of the questions we want to answer in the project.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-4 Project Title +++++++++++++++
Designing HPC Job Schedulers of the future: A Reinforcement Learning based approach

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
Job schedulers be it running on clusters or embedded platforms rely on handcrafted scheduling heuristics for taking efficient application-to-architecture mapping decisions. Although the topic of scheduling has been extensively studied for several decades now, existing heuristics do not consider the myriad of data-parallel optimizations that are available for modern heterogeneous CPU-GPU platforms. As platform architectures continue to evolve and novel optimizations continue

being proposed, it becomes cumbersome to continuously adapt and refine existing scheduling policies. We believe an intelligent scheduler that learns such policies in a self-learning fashion is the need of the hour. In this regard, we would like to explore Reinforcement Learning as a tool that would enable the job scheduler in learning scheduling heuristics for heterogeneous platforms in a future proof manner.

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-5 Project Title +++++++++++++++
Probabilistic programming for Autonomous Driving

+++++++++++++++ BTP-5 Project Summary +++++++++++++++
The major problem in synthetic data generation is producing meaningful data that is not simply random but reflects properties of real-world data or covers particular cases of interest. In this project, we want to investigate how a probabilistic programming language can be used to guide data synthesis by encoding domain knowledge about what data is useful. Specifically, we focus on data sets arising from scenes, configurations of physical objects: for example, images of cars on a road. We plan to use Probabilistic programming framework for potentially unsafe scene generation and test vehicle safety by integrating the scenes with Autonomous driving simulators

+++++++++++++++ BTP-5 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Aritra Hazra

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Explainability of Deep Learning and Adversarial Decisions

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Interpreting the decisions made through neural network (deep learning) models are essential in order to deploy such learned solutions in practice. We try to integrate the logical and neuro-symbolic reasoning concepts to explain such automated decisions. Moreover, the responsibility of the neural network in adversarial decision making is also required to be explained in order to understand the boundaries of such learned models. This work will aim to automate such interpretation based on formal reasoning. Requirements: AI and ML know-how, Coding (C/C++, Python) expertise with PyTorch,TensorFlow etc. handling

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++
This project will be jointly supervised with Prof. Partha P. Chakrabarti.

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Understanding the Synergy and Variations in Human vs. Machine Cognition in Problem Solving

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
How do humans solve a jigsaw puzzle? How will machine solve the same? How will the cognition for such problem formulation and solving changes with multiple humans participating in co-operation to solve the same? This work aims to study the synergy and variations in collaborative problem solving for humans vs. machines. We shall aim to build an automated framework (play-ground) to enable this and showcase the relationship, particularly in jigsaw puzzle solving settings. Requirements: AI and ML know-how, Coding expertise

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++
This project will be jointly supervised with Prof. Partha P. Chakrabarti.

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Developing a Framework for Formal Analysis of Energy-Complexity for Programs

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
Traditional metrics to determine the efficiency of a program rely upon the measurement of time and space complexities. However, energy efficiency of a program is also becoming one of the primary attribute in this frontier, particularly due to stringent power budgetary needs of complex applications that runs in modern day devices. This project aims to develop a formal framework where the energy-complexity of a given program will be analyzed based on an underlying platform-level or architectural-level energy specification model provided. Requirements: Algorithm know-how, Coding expertise

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name   : Pallab Dasgupta

+++++++++++++++ BTP-1 Project Title +++++++++++++++
AI with safety shield ? A disabler/enabler for Intelligent Cyborgs

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
How do we enable future machines to learn safe actions? Think about the simple setting where a bot explores a grid world depicting an island, and water blocks that are unsafe for the bot. The robot contains several actuators with multiple control choices for 1) slow and steady movement, mindful of the surrounding, 2) fast and energy efficient movement which may also be risky. Safety Shield is a no

vel AI method to protect the agent from unsafe states by filtering unsafe actions. How do we train an RL Agent for the bot to find the best policy that is the most rewarding but safe at the same time by switching between the controllers based on the safety shield's feedback? This is one of the questions we want to answer in the project. (Jointly offered with Prof Soumyajit Dey)

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Learning Switched Control with RL policies for Autonomous Driving Systems

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
This is an extension of our HPRL framework which combines AI planning with Reinforcement Learning. The student is expected to develop the following modules: a) RL based controllers that can learn actuation values for throttle, steering, gears, reverse for different road and scenario dynamics. b) High-level controller that can switch between these granular RL agents for smooth and safe operation of the autonomous vehicle. The student will learn to model and analyze the controllers on a vehicle simulation platform like CARLA or Carmaker.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
The role of semi-lexical languages in Indian Raga Music

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
[Caution: This is a project only for students having prior formal training, aptitude, and interest in Indian Raga Music.] Indian Ragas have a loosely defined grammatical fabric and therefore the learning of a raga is mostly imitation based. The combination of imitation based learning and formal languages can be unified using a new concept called semi-lexical languages. This project will explore the role of semi-lexical languages in the cognition of Indian ragas and some specific forms of Indian art. To be able to do this project, the student must have deep understanding and training on several ragas and a very good sense of music.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Animesh Mukherjee

+++++++++++++++ BTP-1 Project Title +++++++++++++++

Perception of users on Facebook about posts having religions

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
Religious hate speech is on the rise in social media. To understand the origins of such hate speech, one needs to understand the perception of people towards different religions. In this project, we will try to understand the perception of online social media users towards different social media posts containing religion. We will use the 10 million URLs provided by the Facebook + Social-Science-one e to understand the same. The dataset contains reactions to different posts which are further categorised demographically. As an additional challenge, the data is differentially private. Hence, appropriate algorithms need to be developed to get relevant statistics.

++++++++++++++++ BTP-1 : Any Additional Note/Comments? ++++++++++++++++
Hate Speech: A post targeting a specific group of people based on their ethnicity, religious beliefs, geographical belonging, race, etc., with malicious intentions of spreading hate or encouraging violence. Offensive: A post containing profanity, impolite, rude, or vulgar language to insult a targeted individual or group. Defamation: A misinformation regarding an individual or group/ an attack on a person's reputation by a false publication.

++++++++++++++++ BTP-2 Project Title ++++++++++++++++
Hate speech/Offensive language detection with Bengali Dataset (The student should be proficient in reading Bengali.)

++++++++++++++++ BTP-2 Project Summary ++++++++++++++++
As the interaction over the web has increased, incidents of defamation, hate speech, aggression, etc. have increased manifold across the globe. Most of the work in Hate speech/ Offensive language detection is in English. In this work, we will build a novel Hate Speech dataset for the Bengali language. We will collect and manually annotate Bengali posts from different sources, e.g: Twitter, Facebook, News page, political page, etc.). We will label them to different dimensions: hate speech, offensive, defamation, non-hate. Now further each category can be classified into multiple subcategories, based on the target. [Gendered, Geographical, Political, Racial, Religious, etc.] Once we build the dataset, we can explore several classification methods to perform different analysis. The student should be proficient in reading Bengali.

++++++++++++++++ BTP-2 : Any Additional Note/Comments? ++++++++++++++++
Hate Speech: A post targeting a specific group of people based on their ethnicity, religious beliefs, geographical belonging, race, etc., with malicious intentions of spreading hate or encouraging violence. Offensive: A post containing profanity, impolite, rude, or vulgar language to insult a targeted individual or group. Defamation: A misinformation regarding an individual or group/ an attack on a person's reputation by a false publication.

++++++++++++++++ BTP-3 Project Title ++++++++++++++++
Title: Next state prediction in bug life cycle

++++++++++++++++ BTP-3 Project Summary ++++++++++++++++
Abstract: In this project, we predict the final state (or intermediate/next stat

e) of a bug given the bug descriptions, comments, texts. We conduct this experiment on the bugs of packages of Ubuntu platform. In addition, we will try to identify whether a newly reported bug (issue) already exists in the system (duplicate bug detection).

++++++++++++++++ BTP-3 : Any Additional Note/Comments? ++++++++++++++++

++++++++++++++++ BTP-4 Project Title ++++++++++++++++
Enriching the quality of Medical Pages in Wikipedia

++++++++++++++++ BTP-4 Project Summary ++++++++++++++++
In this project, we will perform a thorough analysis of the existing references in the medical pages for a qualitative study. We would then identify what makes a sentence citation worthy in a medical doc. Then we will aim to build an automated solution for suggesting the top k relevant medical resources (citations) to the editors for any medical facts, mentioned in the article. In the next step, the model should be able to cite the references in the appropriate places in the desired sentence.

++++++++++++++++ BTP-4 : Any Additional Note/Comments? ++++++++++++++++

++++++++++++++++ BTP-5 Project Title ++++++++++++++++
Title: Deep Representation learning for Zero-shot demographics Retrieval in Twitter

++++++++++++++++ BTP-5 Project Summary ++++++++++++++++
With the growing base of internet users, it's easier than ever to influence people by introducing bias in online social media by paying influencers. So, it's important to build methods that can automatically identify the stance of people on particular topics and how the demographics respond to an announcement/tweet. In order to achieve this one must adhere to several key design principles: The system must be scalable with few or "no" labeled data(zero-shot/few-shot setting) The system must work on an amalgamation of languages(code-switched data comes with own set of challenges) The system must accurately detect the bias of Twitter users on several topics and should be able to infer from limited multi-modal data. The system must also accurately understand the topic and aspect sentiments on a tweet or article in order to understand the matching to perform the retrieval task. So, we are designing deep learning architectures that can be trained on minimum input for any language/demographics and can predict the inherent bias(religious, political, professional, nationalistic, gender-wise etc.) of a news article or a Twitter user with state of the art accuracy. We will also analyze the results observing the influence of certain influencers and news media across states, religions, and people of different political perspectives across the timeline for 10+ years for multiple democracies helping the political researchers to understand democracies better.

++++++++++++++++ BTP-5 : Any Additional Note/Comments? ++++++++++++++++

+++++++++++++++ BTP-6 Project Title +++++++++++++++
Mitigating Misinformation of Events on Online Social Media

+++++++++++++++ BTP-6 Project Summary +++++++++++++++
Social media has greatly enabled people to participate in online activities at a
n unprecedented rate and it has become one of the most important means to consum
e the latest news. However, this unrestricted access also exacerbates the sprea
d of misinformation and unverified news online which might cause confusion and c
haos unless being detected early for its mitigation. Fake news can take advantag
e of multimedia content to mislead readers and get dissemination, which can caus
e negative effects or even manipulate the public events. With the expeditious na
ture of evolving news events it is arduous to detect the authenticity of the new
ly emerged events mentioned in social media due to the lack of annotated data. D
uring the events like natural disaster or crisis people tend to easily believe t
he contents of postings related to the events, and retweet the postings with hop
ing them to be reached to many other users without proper verification. This stu
dy will be based on the motives for propagating misinformation about an event fr
om a political and non-political perspective, early detection of the fake events
 and the approaches to mitigate the propagation.

+++++++++++++++ BTP-6 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Arobinda Gupta

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Algorithms on Time-Varying Graphs

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Time-Varying graphs are graphs with topologies changing over time. Algorithms fo
r many problems on static graphs do not directly extend to such time-varying gr
aphs. Sometimes even definitions of graph structures like paths etc. do not rema
in valid on time varying graphs. In this project, you will study the design of a
lgorithms (centralized or distributed) on time varying graphs. You should be int
erested in things like algorithms, complexity analysis, proving hardness, correc
tness proofs etc. to take this project. There will most likely be no programming
 involved (there is a chance we may do some in specific cases).

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Data offloading in vehicular networks

++++++++++++++++ BTP-2 Project Summary ++++++++++++++++
Applications running on vehicles nowadays routinely require to upload/download d
ata from backend systems. One option for this is to use the cellular network; ho
wever that may put more load on the cellular network. Data offloading deals with
 offloading some of the data transfer task from cellular networks to other type
of networks such as wi-fi access points placed by the road-side, vehicle-to-vehi
cle networks etc., while still satisfying the application requirements. In this
project, you will study and design data offloading schemes in vehicular networks
, where the inter-vehicle and vehicle-to-roadside communication is sued, along w
ith other schemes, to offload some of the work from the cellular network. Should
 have a good background in basic networks (wireless networks will be good) and a
lgorithms. Will involve both algorithm design and writing programs using tools t
o evaluate them.

++++++++++++++++ BTP-2 : Any Additional Note/Comments? ++++++++++++++++

++++++++++++++++ BTP-3 Project Title ++++++++++++++++
Mobile EV Charging

++++++++++++++++ BTP-3 Project Summary ++++++++++++++++
Electric vehicles (EVs) are becoming more and more popular. However, they are de
pendent on battery charging from time to time. While fixed charging stations are
 being built where EVs can charge their batteries, mobile units that can go to a
n EV and deliver charge to it is also used. In this project, you will design alg
orithms for efficient charging of sets of EVs by a set of mobile charging statio
ns. Problems include routing planning and placement of mobile stations, demand-a
daptive scheduling etc. Should have a good background of algorithms (optimizatio
n problems). Will involve both designing algorithms and programming.

++++++++++++++++ BTP-3 : Any Additional Note/Comments? ++++++++++++++++

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Faculty Name   : Sudip Misra

++++++++++++++++ BTP-1 Project Title ++++++++++++++++
Machine Learning Based modeling and interpretation of data from wearable sensors

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
The sensors used widely for IoT-based healthcare monitoring involve 3-lead ECG s
ensors, pulse oximetry sensors, and many more. However, the analysis and informa
tion extracted from these sensors are not at par to match the clinical purposes.
 Towards this, the aim of the project is to analyze, predict, and reconstruct th
e sensor data to match the clinical standards. (For example, predicting the 12-l
ead ECG signal and detecting any abnormalities from 3-lead ECG sensors.)

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Machine Learning based Network slicing using forecasted medical condition of patients in WBAN

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
ML-based Network slicing using forecasted medical condition of patients in WBAN Description: The flows generated in WBAN are highly delay-sensitive. Network slicing can be used to dynamically allocate bandwidth in the network slice for reducing delay. To support delay-sensitive service in WBAN, design a scheme using machine learning for forecasting the medical condition of the patients in WBAN and allocating the suitable bandwidth in the network slice.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Dynamic encryption in eHealth monitoring systems for secured data transmission

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
The work will focus on dynamically selecting the encryption mechanism of healthcare data at the edge device, received from different health monitoring sensors. Different parameters will be considered for selecting the encryption scheme, such as number of sensors connected to the edge device, data generation rate of sensor modules, bandwidth of the edge device, quality of connectivity between edge device and remote server. The encryption will be based on tuning these parameters as per the to successfully transmit the data to the remote server.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-4 Project Title +++++++++++++++
Crowd management and density pattern recognition in smart supermarkets

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
This project aims to capture the real-time pattern of crowd densities throughout various regions in a smart supermarket (such as groceries, vegetables, electronics, cosmetics etc) using proximity, distance measuring and motion detection sensors. This data can then be analyzed using various learning models in a local fog/cloud for crowd management and bring out various information such as customer purchase behavior, popularity of different products, marketing strategies among others. The real-time data can also be visualized using interactive GUIs.

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-5 Project Title +++++++++++++++
Elevation contour mapping of local terrain using UAV swarms

+++++++++++++++ BTP-5 Project Summary +++++++++++++++
This project aims to use UAV nodes, each equipped with an array of distance meas
uring sensors (like HC-SR04 ultrasound sensors) to map the elevation differences
 of any terrain (such as agricultural field, sports ground etc.) to produce a lo
cal contour map of the region that may be useful for various purposes like level
ling of the field. The UAVs are remotely controlled and can be flown in a swarm
network in such a way that covers every area of the land or according to the req
uirement.

+++++++++++++++ BTP-5 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-6 Project Title +++++++++++++++
Edge Intelligence for Industrial IoT Applications

+++++++++++++++ BTP-6 Project Summary +++++++++++++++
This project will using advanced machine learning techniques for catering to the
 Industrial IoT applications.

+++++++++++++++ BTP-6 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Swagato Sanyal

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Online matching with recourse. https://drops.dagstuhl.de/opus/volltexte/2020/132
52/pdf/LIPIcs-FSTTCS-2020-11.pdf

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Theoretical project. Involves designing algorithms and mathematically deriving b
ounds. No implementation. Pre-requisite: mathematical maturity, liking for forma
l reasoning, comfort with the fundamentals of algorithm design and analysis. Hav
e a look at the shared link to get a sense of what it will be like.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

++++++++++++++++ BTP-2 Project Title ++++++++++++++++
Vector-Matrix-Vector Queries for Solving Linear Algebra, Statistics, and Graph P
roblems https://arxiv.org/pdf/2006.14015.pdf

++++++++++++++++ BTP-2 Project Summary ++++++++++++++++
May be said to come under "theoretical big data". Pre-requisites involve inclina
tion for mathematical reasoning about computation, sound foundation in algorithm
 design and analysis, willingness to build necessary theoretical background. The
oretical project. Involves designing algorithms and mathematically deriving boun
ds. No implementation. Have a look at the shared link to get a sense of what it
will be like.

++++++++++++++++ BTP-2 : Any Additional Note/Comments? ++++++++++++++++

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Faculty Name : Partha Pratim Chakrabarti

++++++++++++++++ BTP-1 Project Title ++++++++++++++++
AI/ML and Game based Methods for Cognitive and Affective Evaluation

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
We plan to develop scalable innovative AI/ML and Gaming based tools for Analysis
 of Cognitive and Affective Behaviour of a variety of individuals. One of the pr
imary issues for cognitive and affective evaluation today is to evolve with gene
ralized conclusions for a larger populace without ignoring the significant behav
ioural patterns in small clusters. This remains a significant challenge as the d
ata collected for cognitive and behavioural evaluation is primarily carried out
in in-vitro conditions, on a one-on-one basis. This is a time consuming and cost
 incurring affair, especially in India, as the number of experts available for e
valuation are limited with variance in expertise as well. The other problem is w
ith data analyses, more so when dealing with large amounts of information about
individual cases. The challenge remains in analyses without losing important inf
ormation. The need for the hour is to build cost effective tools that can captur
e a larger number of signals with high sensitivity for assessment of cognitive
parameters like attention and intelligence, and tools with high specificity for
diagnostic and screening tools for clinical parameters like Dementia, ADHD etc.
We plan to take up development of new generation ML based analysis that combines
 with reasoning, interactive games (single and multi-player). This will also ena
ble creation of larger datasets. Those affected by COVID-19 may also be assessed
 and a unique India based study will be carried out.

++++++++++++++++ BTP-1 : Any Additional Note/Comments? ++++++++++++++++
I can take two students here also if available and interested

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++++++++++++++++ BTP-2 Project Title ++++++++++++++++
Solving Complex Planning Problems with Multiagent, Multi-Task and Multi-layer Re

asoning

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
This problem will address an important AI/ML problem where multiple agents work
on multiple tasks on a problem that has 2 to 3 layers of configuration space. Th
is involves combining search, planning and reinforcement deep learning technique
s. It will also consider partial information spaces and both cooperation and col
laboration scenarios. It has applications in logistics, finance, decision making
 and cooperative knowledge discovery

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++
I can take two students here also if available and interested

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+++++++++++++++ BTP-3 Project Title +++++++++++++++
Human in the Loop Online Learning of Bayesian Neural Networks for Surgical Video
 Analysis

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
Surgical video analysis is gaining importance with inclusion of robotic and mini
mally invasive processes within the operating room (OR). Given the diversity of
visual appearance and motion activity, training machine learning models for anal
ysing such videos across low level tasks like surgical tools and phase recogniti
on to high level tasks like next activity prediction, requires a large collectio
n of annotated data. A single procedure lasts for about 2-4 hours recorded on vi
deo shot at 25 frames per second making it an overwhelming task to annotate them
 manually. This project is on developing artificial intelligence (AI) methods in
cluding computer vision (CV), Bayesian learning (BL), neural networks (NN) to le
arn with a small volume of manually annotated data, predict on unseen data and h
ave the predictions corrected by a Human expert in the Loop, ingest the correcti
ons to annotations within the AI annotator and correct it, to evolve into an onl
ine learning system. Bayesian learning is incorporated to account for the probab
ilistic nature of activities, and also to incorporate the statistical correlatio
n between past phases of surgery to the future phase, succession of activities i
n each phase of a surgery, group of tools used in a succession in every activity
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+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++
I can take two students here also if available and interested

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+++++++++++++++ BTP-4 Project Title +++++++++++++++
AI/ML Based Smart Grid Scheduling Algorithms Using Reinforcement Learning

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
Both demand side management and unit commitment are important problems for power
 system networks. Demand side management tries to schedule the different applian
ces (deferrable, non-deferrable, thermal-aware, energy-aware, etc.) intelligentl
y so that total electrical load can match the supply. On the other hand, unit co
mmitment strategy tries to manage the generation of electricity taking into acco
unt generation characteristics such as ramp-up, ramp-down of generators, spinnin
g reserve requirements, etc. An integrated solution for both the problems can im
prove the overall performance. In this project we would like to explore reinforc

ement learning based methodologies for managing energy generation along with scheduling of appliances.

++++++++++++++++ BTP-4 : Any Additional Note/Comments? ++++++++++++++++
I can take one student is they are available and interested

++++++++++++++++ BTP-5 Project Title ++++++++++++++++
AI/ML Based Smart Court Scheduling and Management

++++++++++++++++ BTP-5 Project Summary ++++++++++++++++
Court scheduling is a unique problem with very special data sets. We will develop next generation scheduling algorithms for courts which combine unique scheduling algorithms with data-derived learning algorithms to optimize a variety of parameters covering time, fairness, urgency, etc.

++++++++++++++++ BTP-5 : Any Additional Note/Comments? ++++++++++++++++
I can take one student if available and interested

++++++++++++++++ BTP-6 Project Title ++++++++++++++++
Deep Learning based Analysis of News Bias in the electronic media

++++++++++++++++ BTP-6 Project Summary ++++++++++++++++
We plan to develop a platform that will analyze news bias across segments, time, region, agencies based on sentiment analysis, both individual and differential using language analysis

++++++++++++++++ BTP-6 : Any Additional Note/Comments? ++++++++++++++++
I can take one student if available and interested

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Faculty Name : Mainack Mondal

++++++++++++++++ BTP-1 Project Title ++++++++++++++++
Towards logical fallacy detection via argument mining to defend against online hate speech on Reddit (co-advise with AM)

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
Today, the free and open nature of social media sites often enables free speech. However, the very strength of social media to easily reach millions of users also created huge problems in the hands of malicious actors. For example, recent works has shown that these social media sites are often used for spewing hate, both using implicit (e.g., via gentle nudges) and explicit techniques (e.g., using strong biased language against different groups). In fact, although detecting explicit hate speech is at least possible, detecting implicit hate (e.g., posting

logically fallacious argument to hijack an online debate) is still a largely unsolved problem. To that end, in this project we will focus on Reddit, a social site quite well known for heated online discussions. We aim to use text-centric argument detection and mining techniques to find fallacious argument techniques used by online actors for spreading implicit hate. To know more about our active research publications on hate speech, check: https://cse.iitkgp.ac.in/~animeshm/pub.html and https://cse.iitkgp.ac.in/~mainack/ (ctrl-F for "hate").   Note: We have an active research output requirement, which means that we would expect you to finally have a publishable set of results. Also, you need to spend time on this project from this semester onwards (and if you a dual degree student it's slightly favorable for you given the dedicated time you can devote to your thesis and research work) and start taking baby steps. Which means (for this semester) doing related work, gaining knowledge about the techniques and trying to collect small scale data and doing some analysis. Also, do feel free to contact us prior to opting for this project.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Enabling a post-death privacy-preserving data will for online users

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
Over time, we all accumulate lot of content in our email accounts. Previous work has already established that due to change in relations as well as change in life privacy preferences of this content change. For example, our recent work from CCS'19 identified that over time Facebook users want to change the privacy of 25% of their old content (check out: https://cse.iitkgp.ac.in/~mainack/publications/restrospective-facebook-ccs-2019.pdf). In fact, there is also work on what happens for very old content (e.g., as a special case social media posts of a deceased user). However, emails often contain more sensitive information than social media data. To that end, in this project we want to quantitatively measure what type of privacy do users envision for their email data (e.g., it's okay to share personal mails, not okay to share mails with swear words etc.) and then build a service which can create a privacy-preserving email archive for users which they can pass on to the future generation (like a data will).   For enabling privacy after death (or detecting and creating a system that will help create a data-will) requires skills from Usable Security (I taught last semester, can share materials) and Machine Learning (NLP/DL will be a plus) since the final system should do text/image analysis. The goal is to create a system which can identify data which the user wants to leave for future generation. To know more about privacy after death, see the work by Dr. Jed Brubacker on Post mortem privacy and legacy contact (he is the guy who implemented memorial accounts on Facebook): https://scholar.google.com/citations?user=8LEH940AAAAJ&hl=en Note: We have an active research output requirement, which means that we would expect you to finally have a publishable set of results. Also, you need to spend time on this project from this semester onwards (and if you a dual degree student it's slightly favorable for you given the dedicated time you can devote to your thesis and research work) and start taking baby steps. Which means (for this semester) doing related work, gaining knowledge about the techniques and trying to collect small scale data and doing some analysis. Also, do feel free to contact me prior to opting for this project.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Pawan Goyal

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Improving Exploration in Reinforcement Learning Based Chatbots with Cycle Consis
tency Loss and Stateless Decoders

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Training sequence-to-sequence models for open-domain chatbots is notoriously har
d due to (RNN or Transformer) decoders' limitations arising from using the maxim
um likelihood loss. It also makes effective exploration impossible required to t
rain these models using Reinforcement learning. This project proposes a solution
 to this problem using a cycle consistency loss and a novel stateless decoder.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Cross-Domain Adaptability of Opinion Summarization methods

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
Opinion Summarization of multiple documents/reviews deals with efficiently extra
cting the mentioned aspects and their corresponding sentiments before forming a
concise summary capturing the overall opinions. Sentiment classification, on the
 other hand, is known to be sensitive towards domains as the mode of expressing
opinions across domains vary. However, curation of domain-specific datasets and
gold-standard summaries for each domain is practically infeasible. Hence, there
is a need to investigate the domain-adaptability of current state-of-the-art sys
tems for opinion summarization. Additionally, we would explore domain-invariant
techniques to train a neural summarization model that can generalize across doma
ins. To get a flavor of the task, please read the following paper: https://www.a
clweb.org/anthology/2020.acl-main.175/ https://www.aclweb.org/anthology/2020.acl
-main.461/

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Intentionality in Multilingual Text

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
User characteristics, demographic and different temporal network features are in
volved in human intention dynamics propagation in online social network. Our aim

is to predict intention of an individual or mass people (in an online forum where multiple persons are engaged in a discussion) in multilingual Indian contexts. To build such an efficient system, we need to develop - interlinked multilingual question and answer pairs (QA), and a knowledge graph that supports multilingual entity and relationships.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++
Works Areas : NLP, IR, ML Applications, Cognitive Science Language : Python Preference : Basic NLP/IR knowledge

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+++++++++++++++ BTP-4 Project Title +++++++++++++++
Review-based Product Question Answering

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
While buying a product from the e-commerce websites, customers generally have a plethora of questions. Very often, it takes a long time for an asker to wait for an answer. So, there must be an effective question answering system to provide immediate answers to the user queries. Apart from reviews, product profiles like attribute-values, descriptions can help answer the product question. In this project, we will apply various deep learning techniques which are prevalent in question-answering tasks.

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-5 Project Title +++++++++++++++
Have we understood emotions enough?

+++++++++++++++ BTP-5 Project Summary +++++++++++++++
Sentiment Analysis has been primarily looked at as a multi-way text classification approach. However, merely learning better lexical and syntactic representations using BERT and beating previous state-of-the-art accuracies in the process does not entail true sentiment understanding. While sentiments are often aspect/target-centric, emotions are short-lived and require more fine-grained analysis. Categorical models for emotion analysis classify a given text into discrete coarse-grained classes such as anger, joy, etc. Dimensional models, on the other hand, take a more fine-grained approach in determining the degree of valence, arousal, and dominance in the given text. The interplay between these two philosophies remains under-explored. Additionally, there is a need to understand the relatedness between the tasks of emotion and sentiment analysis which we would like to explore in this project. To get a flavour of the task, please read the following paper: https://www.cse.iitb.ac.in/~pb/papers/ieee-toac-sa.pdf

+++++++++++++++ BTP-5 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-6 Project Title +++++++++++++++
How multilingual BERT-based Question Answering models use word order information for low resources languages?

++++++++++++++++ BTP-6 Project Summary ++++++++++++++++
Pre-trained language models (e.g. Multilingual-BERT, indic-BERT) have been succ
essfully used to solve question answering tasks for low resources languages. In
 this work, we will investigate multilingual-BERT layer-wise to check whether it
 contains any cues of the words order information.

++++++++++++++++ BTP-6 : Any Additional Note/Comments? ++++++++++++++++

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Faculty Name : Rajat Subhra Chakraborty

++++++++++++++++ BTP-1 Project Title ++++++++++++++++
Exploration of Hardware Trojans in High-level Synthsesis

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
High-level Synthesis (HLS) allows Verilog RTL to be generated automatically from
 C/C++ description of algorithms. Hardware Trojans are difficult-to-detect, mali
cious modifications that can affect the functionality of integrated circuits. Th
is project will explore Hardware Trojans and their detection in the context of H
LS.

++++++++++++++++ BTP-1 : Any Additional Note/Comments? ++++++++++++++++
1. Knowledge of Verilog is essential.

++++++++++++++++ BTP-2 Project Title ++++++++++++++++
Exploration of Hardware IP Protection and Logic Locking in High-level Synthesis

++++++++++++++++ BTP-2 Project Summary ++++++++++++++++
High-level Synthesis (HLS) allows Verilog RTL to be generated automatically from
 C/C++ description of algorithms. This project will explore the possibilities of
 protecting hardware intellectual properties (Hardware IPs) in the context of HL
S. Specifically, can "Logic Locking" be applied to HLS?

++++++++++++++++ BTP-2 : Any Additional Note/Comments? ++++++++++++++++
Knowledge of Verilog is essential.

++++++++++++++++ BTP-3 Project Title ++++++++++++++++
Efficient Statistical Tests for True Random Number Generators (TRNGs)

++++++++++++++++ BTP-3 Project Summary ++++++++++++++++
TRNGs are widely used as source of randomness, particularly in cryptographic alg

orithms. The project will explore the porting of existing statistical tests for TRNGs in C to multi-threaded high-performance C or Python (any one of them) implementation.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name   : Partha Pratim Das

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Development of CS context aware vector representations for Deep Code Search

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Code search over large corpora can be beneficial for both beginners and experienced developers as they can quickly find the related code snippets according to their needs. Code search is more effective if developers can express their requirement in natural language. Even though platforms like Stack Overflow (open curated QA) supports developer code search queries but the QA forums cannot handle raw un-annotated source code.   This is the core of the deep code search technique we want to develop for C / C++ programs.   C / C ++ have a diverse and varied program syntax. We need to generate code and annotation string embeddings based on NLP representations of the tokens of the code snippet using recurrent neural network and word vectors model. This task involves use of LSTM networks, various word vector algorithms and various NLP techniques. It also requires the knowledge of scraping text from portals like stack overflow or github.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++
Area: NLP, Recurrent Neural Network, Elmo, Skipgram #Students: 1

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Code Embeddings based on Knowledge graph of Static Structure and Runtime Behaviour for Deep Code Search

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
Even though platforms like Stack Overflow (open curated QA) supports developer code search queries but the QA forums cannot handle raw un-annotated source code. The important aspect is to develop a correct and accurate semantic mapping between the developers intent encoded in the natural language query and the source code / runtime traces. Even though source code / runtime trace or a NL text is of different domains, they can be unified or related through vector representations. This is the core of the deep code search technique, which needs to be implemented for C / C++ code bases. We will generate code embeddings based on the knowledge extracted static structure and runtime traces. We will be using static and dynamic instrumentation framework to extract and create an interrelated knowledge graph which represents the structure and behaviour of a code snippet. This knowledge graph will be further used to create code embeddings based on a vector

space model .This task involves use of deep neural networks, various word vecto
r algorithms and instrumentation frameworks.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++
Area: NLP, Recurrent Neural Network, Static and Dynamic Instrumentation #Studen
ts: 1

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Hands free gesture to crop the image and object using multiple sensors

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
Using the sensors (RealSense, ZED and Kinect) the cropping operations (selectin
g the image/object, defining the cropping area, cropping and shifting the croppe
d part to a defined location on the screen) should be performed using hands free
 gestures

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++
Area: Computer Vision, Image Processing and Machine Learning #Students: 1

+++++++++++++++ BTP-4 Project Title +++++++++++++++
Machine learning approach to classify the motions involved in Bharatanatyam danc
e videos using trajectory as feature

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
Construction of trajectories involved in the motions using the RGB data. The tra
jectories will be used to train the classifier.

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++
Data Set: Video stream (RGB) captured by Kinect V1.0. The motion annotation file
; Marking the motions in a given video.   Area: Computer Vision, Image Processin
g and Machine Learning #Students: 1

+++++++++++++++ BTP-5 Project Title +++++++++++++++
Modeling and extraction of reflective floor plane in an RGBD image captured usin
g a Kinect sensor

+++++++++++++++ BTP-5 Project Summary +++++++++++++++
Kathak dance is captured using Kinect. It involves primarily of feet movement. S
o analysis and segmentation of feet from floor and wall are critical. Various le
arning techniques will be used to do that.

+++++++++++++++ BTP-5 : Any Additional Note/Comments? +++++++++++++++
Area : Computer vision, Machine learning #Students : 1

+++++++++++++++ BTP-6 Project Title +++++++++++++++

Modeling movement of different human hand gestures

+++++++++++++++ BTP-6 Project Summary +++++++++++++++
Modeling movement of different human hand gestures using 3D coordinate geometry
- Finding a possible movement ontology for human body movements

+++++++++++++++ BTP-6 : Any Additional Note/Comments? +++++++++++++++
Area: Machine Learning, Dynamical Systems, Image Processing and Computer Vision
 #Students: 1

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Faculty Name : Bivas Mitra

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Smartphone driven automatic self report collection for emotion prediction

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Emotion detection approaches typically require a large number of self-reports (c
onsidered ground truth) to train the emotion inference model. But self-report co
llection is labour-intensive and fatigue-inducing. So, efficient approaches for
self-report collection are required. Facial expression is one of the key non-ver
bal expressions that correlate with human emotion. In this project, we aim to re
duce the volume of manual self reporting. We would like to explore, if instead o
f manual self-report, we can rely on the smartphone captured photographs and rec
ognize the facial expression at the given point of time, which can work as a pro
xy of the manual self report. Finally, using those automatic self reports, we wi
sh to develop a framework which can infer the users' emotion from the smartphone
 engagements.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Deep learning frameworks for Success/Failure of Meetup groups/events

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
Event based online social services (EBSN), such as Meetup and Plancast, have exp
erienced increased popularity and rapid growth in recent years. In EBSN, a group
 of people organize different types of events such as traveling, technical talks
, eating at restaurants etc. The success of a Meetup group can be perceived from
 the many different directions — organizing big event, having thematically consi
stent attendees, growing group etc. In this project, we aim to leverage on deep
 learning and investigate the success of Meetup groups from different perspectiv
es. The objective is to develop a prediction cum recommendation system which can
 predict the success of a Meetup group and can provide context driven recommenda
tions to the event host/group coordinator to make the group successful.

++++++++++++++++ BTP-2 : Any Additional Note/Comments? ++++++++++++++++

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Faculty Name   : Soumya Kanti Ghosh

++++++++++++++++ BTP-1 Project Title ++++++++++++++++
Machine Learning in Software Defined Network (SDN)

++++++++++++++++ BTP-1 Project Summary ++++++++++++++++
The software defined network (SDN) separates the control plane from the forwardi
ng plane which enables administrators to define and control the network through
the method of software programming, provides a new research direction for the ne
xt generation of network architecture. On the other hand, the machine learning t
echnology has been developed rapidly in recent years and some studies have begun
 to introduce machine learning methods into SDN to improve the efficiency of net
work management and conformity, or to solve problems that cannot be solved easil
y by traditional methods. This project aims at using the supervised learning, un
supervised learning or semi-supervised learning methods to solve some specific p
roblems on SDN.

++++++++++++++++ BTP-1 : Any Additional Note/Comments? ++++++++++++++++

++++++++++++++++ BTP-2 Project Title ++++++++++++++++
Federated Spatial Cloud Infrastructure for Data Analytics and Secured Data Acces
s

++++++++++++++++ BTP-2 Project Summary ++++++++++++++++
Spatial data analytics is gaining importance with availability of spatial data w
ith various organizations in their spatial data repositories. This project aims
at developing an infrastructural support for Cloud Federation with diverse data
centres. We will also explore the features of the well-adopted blockchain techno
logy, which may help in designing a multi-organizational spatial cloud infrastru
cture for geospatial data sharing.

++++++++++++++++ BTP-2 : Any Additional Note/Comments? ++++++++++++++++

++++++++++++++++ BTP-3 Project Title ++++++++++++++++
Cloud-Fog-Dew-IoT enabled Framework for Pandemic Management

++++++++++++++++ BTP-3 Project Summary ++++++++++++++++

The COVID-19 pandemic has shown far reaching sequels in all aspects of human lives ranging from rapid growth in active cases to economic and social disruption across the world. This is much more critical for the developing and under-developed countries, which often have very high population densities and limited health care infrastructure. Further, a large number of citizens are often needed to be quarantined or to be provided home-based treatment. The IoT (Internet of Things) enabled devices and applications have seen a rapid growth in various sectors including healthcare. The Internet of Spatial Things (IoST) combines IoT with spatial context, where location information of the objects plays an important role. To fight against pandemic like Covid-19, spatio-temporal information and health data need to be integrated and analysed to predict the spread of the disease as well as assisting users about the risk of infected. This new emerging domain can be termed as Internet of Spatio-Health Things (IoSHT). This project aims at development of Cloud-Fog-Dew-IoT enabled framework for realization of IoSHT to combat pandemic situation.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name   : Sandip Chakraborty

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Development of a Passenger Safety App for Railways

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
This is mostly a development project, where we'll build up a smartphone app (Android-based) and the corresponding desktop application for passenger information and the safety of railways. The app will facilitate multiple services, including safety during ticket booking (for example, avoiding simultaneous login by using IP masquerading), train running status, passenger feedback, and complaint dashboard, women passenger details, etc.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++
This will be a development project; the students are expected to implement the system. Choose this project if you like coding, web design, and system interface design. This project is offered jointly with Prof. Dipanwita Roy Chowdhury.

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Development of a Passenger Safety App for Railways

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
This is mostly a development project, where we'll build up a smartphone app (Android-based) and the corresponding desktop application for passenger information and the safety of railways. The app will facilitate multiple services, including safety during ticket booking (for example, avoiding simultaneous login by usi

ng IP masquerading), train running status, passenger feedback, and complaint dashboard, women passenger details, etc.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++
This will be a development project; the students are expected to implement the system. Choose this project is you like coding, web design, and system interface design. This project is offered jointly with Prof. Dipanwita Roy Chowdhury.

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Cross Network Blockchain Interoperability

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
Over the past decade, we have witnessed significant advancements in blockchain-based distributed ledger technology, and its applications in real-world systems. Apart from their application in cryptocurrencies, blockchains are now being introduced to business and enterprise use cases. The requirements of privacy, confidentiality, auditability, and scalability for enterprise use cases have led to the development of permissioned blockchain platforms such as Fabric, Corda, etc., which by design are isolated networks of closed groups of participants. However, several use cases require interaction and message exchange across different permissioned networks. For example, an electronic marketplace is typically a multifaceted network having one or more business networks collaborating through B2B transactions and, finally, an open consumer network having B2C operations. One such network is the supply chain of manufacturers, wholesalers, retailers, and finally, consumers, which might involve several isolated permissioned networks such as, carriers forming a logistics network, banks forming a trade finance network, producers forming a supplier network, etc. As a result, the exchange of data and assets between different permissioned blockchain networks as well as between permissioned blockchain networks and end-users (consumers) is essential to fulfilling such use cases. Although there are existing research works that address interoperability of permissionless blockchain networks (especially in cryptocurrencies), the same for permissioned networks is still a challenge. Moreover, interfacing permissioned networks with end-users is an open problem. This project aims at developing such interfacing architecture for blockchain interoperability.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-4 Project Title +++++++++++++++
Learning to Learn Network Behaviors !!

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
The computer networks have become overly complex in the recent times, with the usage of complex signal processing techniques at the physical layer to myrid of new applications running over the network. In this project, we'll explore how we can learn the application behaviors in an explainable way which can facilitate the management of the network. For example, if the network knows that a user watches a high definition movie at night, the network can try to preallocate the bandwidth for that user to ensure a smooth quality of experience.

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++

This is an open research problem. Choose this topic if you are interested in devoting time more on exploring new or visionary idea. As you can understand, I do not have a clear problem statement here, rather just a vision -- we need to brainstorm and convert this vision to our problem statement.

++++++++++++++++ BTP-5 Project Title ++++++++++++++++
How can we use on-device computing for safe driving?

++++++++++++++++ BTP-5 Project Summary ++++++++++++++++
Tesla (among others) has launched the commercial self-driving car -- you know that. But can we run a self-driving car on Indian rodas? Do you have any dream about that? Well, it might take a generation to see it a reality, but can we atleast design a mechanism to make the driving safe on "roads with a chaos"? Can you think of a new service or application over a smartphone which can sense the driving environment and can accordingly help the driver and / or passengers while in driving?

++++++++++++++++ BTP-5 : Any Additional Note/Comments? ++++++++++++++++
This is also a visionary project. We developed a few of such apps, see https://doi.org/10.1145/3240323.3240359 or https://doi.org/10.1109/PERCOM.2019.8767410; now just thinking of whether we can develop something more, by exploiting the current research space of computing and learning. If you have some idea, we can explore !!

++++++++++++++++ BTP-6 Project Title ++++++++++++++++
Learning the (System) Logs

++++++++++++++++ BTP-6 Project Summary ++++++++++++++++
Can you imagine what is the amount of logs generated per day when you work on your laptop? Check this -- https://help.ubuntu.com/community/LinuxLogFiles. Now, what useful can we do from these logs? One idea is to analyse these logs through some intelligent learning-based mechanism to see whether we can predict a system fault a priori before it actually happens. This might be possible, because a fault does not occur once of a sudden, rather many exceptions are generated which then triggers a fault. If a system can learn those signatures of exceptions, it can automatically predict a fault. This project aims at developing such a mechanism.

++++++++++++++++ BTP-6 : Any Additional Note/Comments? ++++++++++++++++
You can get a similar idea here -- https://www.cs.utah.edu/~lifeifei/papers/deeplog.pdf. It talks about anomalies, but we'll explore the problem from a more generalized notions of system faults, for example, say slow Internet due to some packet buffer issues.

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Faculty Name : Palash Dey

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Fair voting

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
Fairness in the context of algorithm design is an active area of research. We wi
ll study fairness in the context of voting in this project.

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Fair kidney exchange

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
Fairness in the context of algorithm design is an active area of research. We wi
ll study fairness in the context of the kidney exchange problem in this project.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Voting and privacy

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
To choose the best candidate as the winner, voters must provide their detailed p
reference over the candidates. However, this may compromise privacy of voters. T
his project explores the trade-off between voting efficiency and privacy.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-4 Project Title +++++++++++++++
Byzantine fault tolerance

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
In a Byzantine fault, a component such as a server can inconsistently appear bot
h failed and functioning to failure-detection systems, presenting different symp
toms to different observers. It is difficult for the other components to declare
 it failed and shut it out of the network, because they need to first reach a co
nsensus regarding which component has failed in the first place. We will study v
arious kinds of Byzantine fault tolerance algorithms in this project.

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Debdeep Mukhopadhyay

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Multiparty Post-Quantum Fully Homomorphic Encryption

+++++++++++++++ BTP-1 Project Summary +++++++++++++++
The advent of cloud computing potentially allows individuals and organizations to outsource storage and processing of large volumes of data to third party servers. However, this leads to privacy concerns - clients typically do not trust service providers to respect the confidentiality of their data. This lack of trust is
fortified by threats from malicious insiders and external attackers.

A simple and efficient solution for ensuring the privacy of user information is to encrypt the user data before offloading it to the cloud. However, if the data is encrypted using some conventional encryption algorithm (for instance, using the Advanced Encryption Standard a.k.a AES block cipher), then the cloud
loses all ability to compute on the data without decrypting it first. This leads to a question that has, over the past 30 years, turned into the holy grail of modern cryptography: can we design encryption schemes that allow performing arbitrary computations directly on encrypted data without the need for decryption?

Over the years, multiple cryptographic solutions have been proposed to solve this problem. However, a drawback of many of these solutions is that their security relies on one of three hard mathematical problem the integer factorization problem, the discrete logarithm problem or the elliptic-curve discrete logarithm problem. All of these problems can be easily solved on a sufficiently powerful quantum
computer running Shor's algorithm. Given the recent advances in the design of quantum computers, the aforementioned question must therefore be revisited as followed: can we design quantum-resistant encryption schemes that allow performing arbitrary computations directly on encrypted data without the need for decryption?

A plausible answer to this question is fully homomorphic encryption (FHE). At a high level, FHE is an encryption scheme that allows evaluation of complex programs (alternatively, circuits of any (pre-defined) depth and size) on encrypted data, without the need to access any decryption key. The first candidate FHE construction was proposed by Gentry in a breakthrough result in 2009. Gentry’s work led the way for a plethora of new propositions in subsequent years, all of which share the following desirable property: their security can be based on worst-case lattice-based hardness assumptions such as Learning with Errors (LWE), against which no known quantum attacks exist. The security of most existing FHE proposals crucially relies on secure storage of the decryption key.

However, assuming that a single device/server is responsible for secure storage results in a single point of failure, which is undesirable. For example, a client owning multiple devices (laptops/smartphones/smart watches etc.) might wish to

distribute the storage of his/her FHE decryption key across these devices, such that security is not compromised even if a limited number of these devices are broken into. Informally, an FHE scheme that allows such distributed key-generation and decryption is called threshold FHE (TFHE).

Threshold FHE has numerous exciting applications, one of which is threshold signatures. Threshold signatures have garnered a lot of attention due to their applicability in blockchain technologies, cryptocurrency wallets, smart contracts, and more generally in multi-party computation. A recent work by Boneh et al. in Crypto 2018 showed that threshold FHE can be used to build a universal thresholdizer - a generic crypto-compiler that can transform most standard cryptographic primitives into their corresponding threshold versions, equipped with distributed key generation and storage. Threshold FHE promises to be one of the most disruptive cryptographic technologies, with potentially far-reaching impact upon the areas of encrypted computing and distributed computing. However, several roadblocks exist towards the full-fledged deployment of threshold FHE schemes in real-world systems.

There exist today only a handful of proposals for threshold FHE. Existing proposals, such as the ones by Mukherjee and Wichs [Eurocrypt€™16] and by Boneh et al. [Crypto€™18] incur huge overheads in terms of communication, storage and encryption/decryption performance. They also lack concrete efficiency analysis, which makes it very difficult to judge their suitability for deployment in practical applications.

Hence, we wish to address the following open question in this project: Can we design and implement concretely efficient quantum-resistant fully-homomorphic encryption schemes with. threshold decryption?

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Fault Attacks on Post Quantum Crypto

+++++++++++++++ BTP-2 Project Summary +++++++++++++++
Quantum computers threaten public key encryption. To prevent a plethora of public key algorithms have been. proposed which. are called post quantum cryptographic algorithms (see: https://csrc.nist.gov/Projects/post-quantum-cryptography/round-3-submissions). Along with the algorithms, it is of utmost importance to implement them ensuring efficiency and resistance against side channel attacks. Side channel attacks are a powerful attack vector which tries to monitor the side channel behavior, like timing characteristic etc to reveal the secret. information. One interesting and lethal form of attacks are by considering the. effect of bugs or faults in the computation. Attacks which study the behavior of faults to determine the secret keys are called as fault attacks. In this project, we aim to analyze the. fault tolerance of. these. crypto algorithms and use them as attack vectors. The final goal to develop the crypto-systems with suitable safeguards to rule out such attack vectors.

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Computer Architecture for Machine Learning

+++++++++++++++ BTP-3 Project Summary +++++++++++++++
Despite of lots of promises from cloud computing, security has been a major bott
leneck to adapt cloud for worldwide applications. Due to incomplete control over
 who can access sensitive data and limited monitoring capability of data in tran
sit to and from cloud applications, theft of data from cloud domain or organizat
ional servers is very common. Starting from compromise of 3 billion-user account
s pf Yahoo [2012], Theft of 56 million credit/debit card information from Home D
epot [2014], data breach in Microsoft [2010] and Dropbox [2012], finally high-pr
ofile cloud security breach in Apple iCloud [2014] proved that it is not enough
to trust only the security promises made by the cloud service providers. Startin
g from big names for cloud computing services like Apple-iCloud, Google, Microso
ft Azure and other organizations are also concerned about this data security iss
ues in cloud. One immediate solution is to upload the data encrypting with tradi
tional encryption schemes, which may conform data security, but processing on th
at encrypted form of data is not possible. That defeats the purpose of cloud com
puting as huge computing resources of cloud cannot be utilized and encrypted dat
a in cloud need to be taken back in repeatedly for decryption to process further
. Hence, it is important to design suitable algorithm translation techniques tha
t can support analysis and performing analytics directly in encrypted domain.

The primary objective of this project is to develop search and analytics perform
ing modules suitable for outsourced cloud data stored in secure form. Machine le
arning as a service (MlaaS) is a category of cloud computing services that provi
des machine-learning tools to run, develop and manage applications in cloud with
out the complexity of building and maintaining. The ascent of machine learning a
s a service procreate scenarios where one faces concealment dilemma: how to dele
gate the processing power in cloud environment without giving access to the crit
ical datasets? Hence, cloud data security is an important issue. Homomorphic Enc
ryption (HE) assures to accommodate these conflicting interests in the cloud sce
nario by preserving data confidentiality as well as performing processing in sec
ure domain. However, developing suitable tools to execute analytic algorithms op
erating on encrypted data on general purpose computers requires the design of su
itable circuit-based non-traditional translations of algorithms with the support
 of underlying homomorphic primitives. Design of such efficient homomorphic encr
ypted analytic modules is the main aim of this project.

The aim of the project is as follows:

1. Determine the limitations of state of secure cloud computing algorithms.
2. Develop new circuit based homomorphic encryption tools.
3. Identify secure ways to outsourcing critical data to the cloud.

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-4 Project Title +++++++++++++++
Privacy breach in Deep Learning through Computer Architecture

+++++++++++++++ BTP-4 Project Summary +++++++++++++++
Most of the modern applications that we use in our day-to-day life are powered b

y Deep Learning (DL) algorithms. The colossal success of such applications depends on the amount of data used to train efficient DL models. Starting from our search query, browsing history, purchase transaction to our video preference are few types of information that are being collected and stored on daily basis to design an effective personalized experience from such DL applications. This data collection happens within our mobile devices and computers, on the streets, and even in our own offices and homes. Thus, DL brings additional challenges to protect the confidentiality of user data, as sensitive data is fed into the model during training. The privacy of a DL model user is seriously affected by different attack surfaces - one of them is Membership Inference attacks. Given a DL model and a sample of adversary's knowledge, a Membership Inference attack aims to determine if the sample was a member of the training set used to build the target DL model. This attack could be useful for an adversary to understand whether a certain individual's record was used to train the target DL model, which in turn affects privacy by leaking sensitive information of a user. Moreover, in recent literature, researchers have shown that an adversary sharing the same computing environment with a user can retrieve hyper-parameter information (i.e., number of layers, types of activation functions, etc.) of the user's DL application by using side-channel information leakage through architectural footprints. In addition to that, researchers have also shown that training data sequences are sometimes unintentionally memorized by the DL applications while training, which also risks leaking sensitive user data.

In this project, we investigate the applicability of such privacy-breaching attacks on DL applications through computer architectural exploration. The question that we try to solve in this project is: how secure are the implementations of a DL algorithm against leaking any information which can lead an adversary to sensitive data of a user? The existence of information leakage is intuitive as for different inputs, different sets of neurons activate and process the information. This variation in activations will create different footprints on different computer architectural modules. Hence, we will study different modules to find an answer to the question. We will also look into proposing countermeasures to prevent such information leakages.

The aim of the project is as follows:
Investigate privacy-leakage in Deep Learning implementation through Computer Architecture.
Develop countermeasures of such information leakages.

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : K. S. Rao

+++++++++++++++ BTP-1 Project Title +++++++++++++++
NPTEL Video indexing and retrieval

+++++++++++++++ BTP-1 Project Summary +++++++++++++++

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Audio-visual spoof detection

+++++++++++++++ BTP-2 Project Summary +++++++++++++++

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Unsupervised pattern discovery

+++++++++++++++ BTP-3 Project Summary +++++++++++++++

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

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Faculty Name : Sudeshna Sarkar

+++++++++++++++ BTP-1 Project Title +++++++++++++++
Language Models in NLP for multilingual tasks

+++++++++++++++ BTP-1 Project Summary +++++++++++++++

+++++++++++++++ BTP-1 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-2 Project Title +++++++++++++++
Explainable AI using Knowledge Graphs

+++++++++++++++ BTP-2 Project Summary +++++++++++++++

+++++++++++++++ BTP-2 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-3 Project Title +++++++++++++++
Graph Neural Networks and Neural Symbolic Computing

+++++++++++++++ BTP-3 Project Summary +++++++++++++++

+++++++++++++++ BTP-3 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-4 Project Title +++++++++++++++
zero-shot Crosslingual Question Answering

+++++++++++++++ BTP-4 Project Summary +++++++++++++++

+++++++++++++++ BTP-4 : Any Additional Note/Comments? +++++++++++++++

+++++++++++++++ BTP-5 Project Title +++++++++++++++
Exploring Media Bias in Electronic media

+++++++++++++++ BTP-5 Project Summary +++++++++++++++

+++++++++++++++ BTP-5 : Any Additional Note/Comments? +++++++++++++++

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