Year-7_ CVDI IP Report

The following tables list the Intellectual Property (IP) items developed for each Year 7 project that are available for licensing, along with a description of key features.

Project reports containing detailed information about the associated research results will be sent separately.

The ID numbers that appear in the tables are identified by the following patterns: IP Item: Project-[Project #]-[Item #]

CVDI Project 7A.001.UL – Fault-tolerance Strategies for Handling Data-streams on Edge-Networks: Application to Smart Buildings, Drs. Raju Gottumukkala, Satya Katragadda, Sana Tafleen, Majid Hosseini (University of Louisiana at Lafayette)

IP Item Description
P – 7A.001.UL - 1 : A software prototype that enables user to perform descriptive and predictive analytics on continuous data streams arriving from multiple sources in the context of smart building. The software module runs on multiple edge devices, and recovers when there is a failure. Languages/Technologies: Java, python, Apache Edgent, sensor streaming API's.
Key Concept 1: Performs simple aggregation, join queries at the edge on data streams.
Key Concept 2: The edge device can consume data streams from multiple sources (using push and pull mechanisms).
Key Concept 3: Archives historical data in a time series database (in a reliable cloud environment).
Key Concept 4: A fault tolerance buffering and network rules that minimizes data loss, latency and recovery time in the presence of edge device failure.

IP Item Description
P – 7A.001.UL - 2 : An occupancy forecasting algorithm/model that forecasts room and desk occupancy based on historical data. Languages/Technologies: Python, Keras.
Key Concept 1: Forecasts the start time and duration of when a room would be occupied based on the day of the week, month, historical occupancy patterns.

CVDI Project 7A.016.DU – Continual Learning Framework for Domain Adaptation and Provenance Tracking, Drs. Gail Rosen, Zhengqiao Zhao, Alexandru Cristian (Drexel University)

IP Item Description
P – 7A.016.DU - 1 : Incremental metagenomic taxonomic classification framework Language: bash, C++, Python; Technology: Naïve Bayes Classifier and its incremental variation.
Key Concept 1: Continuous update itself with new labeled data only.
Key Concept 2: No access to existing database required.

IP Item Description
P – 7A.016.DU - 2 : Novelty detection method Language: bash, Python; Technology: Naïve Bayes Classifier, Random Forest Classifier.
Key Concept 1: Using new labeled data as novel data to train a classifier to detect novelty.
Key Concept 2: Using posterior distribution from Naïve Bayes classifier as evidence to detect novelty.

CVDI Project 7A.021.TUT – Early Detection of Myocardial Infarction Using Echocardiogram Images, Drs. Moncef Gabbouj, Serkan Kiranyaz, Morteza Zabihi, Aysen Degerly (Tampere University of Technology)

IP Item Description
P – 7A.021.TUT - 1 : Work not yet complete for IP, **s**till under consideration. The achievement include pseudo labeling to generate ground truth mask for LV location, tuning two state-of-the-art CNNs to segment the LV muscle, designing a flickering detection to present MI misclassification.
Key Concept 1: Provide the ground truth mask for the LV in the echo dataset using deep learning.
Key Concept 2: Using a semi-automated process we drastically decrease the doctors' burden.
Key Concept 3: Fully automated segmentation of the full LV muscle in echo videos with 4 chamber views.
Key Concept 4: Comparative analysis of two different CNN topologies for LV detection.
Key Concept 5: Propose am ensemble of CNNs and flickering detection to increase the MI detection accuracy.
Key Concept 6: Motion tracking of the detected LV muscle in echo video for early MI detection.

CVDI Project 7A.022.TUT – Unsupervised Color Constancy Using Adversarial Learning, Drs. Moncef Gabbouj, Jenni Raitoharju, Alexandros Iosifidis, Firas Laakom, Jarno Nikkanen (Tampere University of Technology)

IP Item Description
P – 7A.022.TUT - 1 : Work not yet complete for IP, **s**till under consideration at this time. The achievements include a novel CNN-based color constancy algorithm, called BoCF, based on Bag-of-Features Pooling. The proposed model is both shallow and able to achieve competitive results across multiple datasets compared to the state of the art.
Key Concept 1: A novel CNN-based color constancy algorithm, based on Bag-of-Features Pooling.
Key Concept 2: The proposed model is shallow and able to achieve competitive results compared to the state of the art.
Key Concept 3: We establish explicit links to prior statistical methods for illumination estimation.
Key Concept 4: Two novel attention mechanisms are also proposed to improve the results.

CVDI Project 7A.024.TUT – Real-time Data Analytics Using Edge Computing Infrastructure with Applications for Smart City, Drs. Moncef Gabbouj, Jenni Raitoharju, Honglei Zhang, Lei Xu, Juhani Ahonen (Tampere University of Technology)

IP Item Description
P – 7A.024.TUT - 1 : Work not yet complete for IP, **s**till under consideration at this time. The work done includes two generative models: VAE and GANs to detect and locate cracks and potholes on road surface. The work needs to consider in the future distributed computing in order to achieve real-time detection.
Key Concept 1: Dataset of road surface anomalies.
Key Concept 2: Generative models: VAE and GANs to detect and locate cracks and potholes on road surface.
Key Concept 3: Evaluation of new models and comparison with existing methods.
Key Concept 4: Realization and integration to the proposed system.

CVDI Project 7A.025.TUT – Intelligent Buildings, Drs. Moncef Gabbouj, Jenni Raitoharju, Nikolaos Passalis, Mehmet Yamac, Matti Vakkuri, Steve Greenspan (Tampere University of Technology)

IP Item Description
P – 7A.025.TUT - 1 : Work not yet complete for IP, **s**till under consideration at this time. The work done includes the design of a data monitoring system, which is a) privacy-preserving and b) energy-efficient.
Key Concept 1: Dataset collection, MUVIS-VMD.
Key Concept 2: Three user levels: semi-authorized user A (with key A only), the fully authorized user B (with key A and B), is allowed to recovery full signal, while a third-party user without the keys is not allowed to recover any piece of information.
Key Concept 3: A low cost and practical system for use in privacy-preserving data collection from sensory devices.

CVDI Project 7A.026.TUT – Improving Speech Recognition Robustness, Drs. Moncef Gabbouj, Okko Räsänen, Ali Senhaji, Filip Ginter (Tampere University of Technology)

IP Item Description
P – 7A.026.TUT - 1 : Work not yet complete for IP, **s**till under consideration at this time. The achievements include the creation of dataset for Finnish language, proposing new aata augmentation to train robust ASR systems, especially when faced with limited datasets.
Key Concept 1: Identify the state-of-the-art architecture.
Key Concept 2: Create a Dataset based on public domain resources for Automatic Speech Recognition task in Finnish language.
Key Concept 3: Determine appropriate metrics for robustness.
Key Concept 4: Benchmark different augmentation methods and propose a training strategy.

CVDI Project 7A.028.TUT – Co-botics: Intelligent Cooperating Robots & Humans-Phase II, Drs. Moncef Gabbouj, Jenni Raitoharju, Alexandros Iosifidis, Fahad Sohrab, Kateryna Chumachenko, Matti Vakkuri, Peter Matthews, Steven Greenspan (Tampere University of Technology)

IP Item Description
P – 7A.028.TUT - 1 : Work not yet complete for IP, **s**till under consideration. The achievements include the creation of novel methodologies and decision-making strategies for multi-view and multi-model data analysis in the human-machine systems.
Key Concept 1: New methodologies and decision-making strategies for multi-view and multi-modal data analysis for Multi-modal datasets.
Key Concept 2: Trained models of multi-modal data embedding for anomaly detection, detection of unexpected events in human-robot environment.
Key Concept 3: One-class classification and data analysis and decision making in the latent space.
Key Concept 4: Efficient implementation.

CVDI Project 7A.029.TUT – Very Fast Nearest Neighbor Retrieval in High-Dimensional Domains, Drs. Teemu Roos, Petri Myllymäki, Gür Ersalan, Ville Hyvönen, Jukka Kohonen, Janne Leppä-aho, Kimmo Valtonen (Tampere University of Technology)

IP Item Description
P – 7A.029.TUT - 1 : Improved techniques for indexing high-dimensional data to enable fast nearest neighbor queries. C++/Python/MRPT package.
Key Concept 1: Fault-tolerant parallelization framework (not yet fully developed).
Key Concept 2: Automatic tuning of hyperparameters for optimized query performance.

CVDI Project 7A.027.SBU – The Intelligent Dashboard, Drs. Darius Coelho, Bhavya Ghai, Arjun Krishna, Klaus Mueller (Stony Brook University) Stephen Greenspan, Maria Velez-Rojas (CA Technologies) Brian Foose (Smith Glaxo Kline) (Stony Brook University)

IP Item Description
P – 7A.027.SBU - 1 : Automatically finds interesting patterns in multivariate data and ranks them according to a human-centric interestingness score.
Key Concept 1: Automatic ranking of patterns in multivariate data.
Key Concept 2: Interestingness score relevant to human cognition and perception.

IP Item Description
P – 7A.027.SBU - 2 : Automatically extracts analytic relationships between analytical tasks and data attributes from domain specific document corpora. Relationships are then ranked based on their strength.
Key Concept 1: Automatic identification of analytical tasks for attributes in multivariate data.
Key Concept 2: Ranks tasks based on relevance in the data domain.

IP Item Description
P – 7A.027.SBU - 3 : Automatically assigns the best fitting visualization to a data pattern, given a user's organizational role, task, clearance, visual literacy, and data exploration tasks, such as exploration, prediction, monitoring, etc..
Key Concept 1: Automatic determination of best base visualization for a given data pattern.
Key Concept 2: Automatic determination of best base visualization flavor for a given data pattern.
Key Concept 3: Applies multiple organization criteria such as user's organizational role, task, and clearance.
Key Concept 4: Applies multiple personal criteria such as visual literacy data and preferences.

IP Item Description
P – 7A.027.SBU - 4 : Automatically assembles these ranked best fitting visualizations into a small, optimal, and consistent ensemble for integration into an informative dashboard.
Key Concept 1: Automatic assembly of visualizations into a small and consistent ensemble.
Key Concept 2: Optimization of the ensemble's size and magnitude based on the conveyed information.
Key Concept 3: Automatic integration and organization of this ensemble into an informative dashboard.

CVDI Project 7A.035.UVA – Improved Decision Making for Autonomous Systems,
Dr. Cody Fleming
(University of Virginia)

IP Item Description
P – 7A.035.UVA - 1 : A software prototype capable of predicting the intent and future behaviors of autonomous agents in a multi-agent, dynamic setting. The software architecture takes a history of autonomous system or agent states including location, orientation, speed, and type of system, then predicts its next state(s) either for one-time step in the future or multiple time steps in the future. The prototype explicitly models the effect of multiple agents on one's own behavior, as well as each other's behaviors. Languages/technologies: Python, TensorFlow
Key Concept 1: Model the behavior of autonomous agents as functions of both their own characteristics such as state, system type, goals, etc, as well as other adjacent agents' behaviors.
Key Concept 2: Capture the coupling between agents over a time horizon using Long-short Term Memory (LSTM) networks.
Key Concept 3: Use attention mechanisms to weight which aspects of preceding trajectory are most predictive of future trajectories.

IP Item Description
P – 7A.035.UVA - 2 : A software prototype capable of generating candidate trajectories for an autonomous system based on the prediction of other agents. The prototype selects an optimal trajectory, primarily based on maintaining safety but also approximating human-operated trajectories and other objectives such as efficiency, speed, etc.. Languages/technologies: Python, TensorFlow
Key Concept 1: Leverage trajectory prediction to learn a parametric safety distance.
Key Concept 2: Encode parametric safety distance in terms of encounter geometries, e.g. crossing, head-on, following, parallel maneuvers, etc..
Key Concept 3: Then use safety distance to determine optimal trajectories and maneuvers.
Key Concept 4: Use attention mechanism to provide operator decision support.
Key Concept 5: Attention mechanism can `explain' why a trajectory is optimal and what part of the past is most/least indicative of the future.