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Elias Pålsson - Steer-by-wire with Force-Feedback for Marine Crafts - SAAB BU-Docksta / Dockstavarvet AB

The objective of this master's thesis was to implement and test a Steer-By-Wire (SBW) system with Force-Feedback on Combat-boat 90 (CB90) designed by Dockstavarvet and the Swedish Defence Materiel Administration (FMV). The CB90 uses waterjets at its stern to propel itself, and to control the boat a hydraulic steering system is currently used. A SBW system, as the name suggests, uses wires to send electrical signals to actuators, as opposed to a hydraulic system where turning the steering wheel, which is connected to the hydraulic pump, causes the waterjet nozzles to move. A SBW system allows for a reduced weight as it eliminates the need for a mechanical link between the manual control unit and actuators. It also gives the opportunity to tune how the steering should behave, increasing steering feel and safety. However, when removing the mechanical connection between the steering wheel and the hydraulic pump, you also remove the feedback felt when steering, which can cause pilot-induced oscillations. However, with an external brake connected to the steering wheel this feedback can be replicated. In this project two different electro-magnetic particle brakes were tested and evaluated. The goal of this project was to see whether a SBW system with force-feedback could replicate, or improve, the steering feel compared to the current hydraulic system. Multiple steering ratio curves, which could alter how much the boat turns when turning the steering wheel, were designed and tested. Three brake curves were also designed, which altered how much and when the brake should be activated when the steering wheel turned faster than the waterjet nozzles. To test the SBW system three experienced combat boat pilots from Dockstavarvet and one previous member of the Swedish Amphibious Corps were asked to evaluate the steering feel with the SBW rig. The tests were done during high and low velocities, testing how it felt during fast turns as well as checking the course stability. The results after testing the system on the CB90 was that all combat boat pilots confirmed that the SBW system could replicate the steering feel of the hydraulic system. One of the pilots even preferred the SBW system. The final result was a Steer-By-Wire rig with Force-Feedback that could replicate the steering feel of the hydraulic system.

Eric Rantala - Optimization of a damping system's performance using machine learning – BAE Systems Hägglunds AB

This thesis investigates the issue of time lag between the desired pressure, that is calculated by the onboard computer of a vehicle's damping system, and the actual output pressure delivered by the system. The study focuses on modeling this delay using machine learning techniques to be able to simulate the real world damping better in a computer simulation. This study also focuses on finding a proof of concept for one of the models to be able to reverse this time lag when it is applied to the damping system in the real world. The time lag model F1 was created by evaluating the performance of three different machine learning models, convolutional neural network (CNN), recurrent neural network (RNN), and long-short term memory (LSTM), by feeding them an input sequence of data points for it to the predict the next value of that sequence and compare it to the actual output pressure from real world data. While the reversing of the time lag model F2 was trained in two stages, firstly by using actual output as an input for F2 and comparing the prediction against the desired input. In the seconds stage we fine tuned the F2 model by applying the F1 model on the predictions of F2 and comparing it against the desired input. It was found that all three models for F1 performed well, however the CNN performed better especially at higher pressure thus that is the model that should be used in simulation. For F2 we also found that this two stage process worked well for lower pressures but hade more problems for steeper and higher pressures but works as a proof that this solution will work.

Jonas Pettersson - Static and dynamic studies on bi-layer Ag-Au porous structure – Umeå University, Department of Physics, Ultrafast Nanoscience group

Metamaterials are engineered materials to give new or improve properties that nature does not naturally provide. Materials with nanoporous structure have shown to produce plasmonic effects, an phenomenon that can alter materials optical properties at nanoscale, which may potentially provide applications such as all-optical transistors and optical computers. The focus of this thesis is to study nanoporous materials of gold, silver and bi-layer gold-silver by analyze the charge dynamics in the samples and as well compare the result with bulk samples. The research was done in two parts; static and dynamic measurements. Static was to collect the optical properties and to obtain images of the nanoporous structure. Dynamic part was to analyze how the electrons behaved in the materials by pump-probe spectroscopy; a measurement technique which uses two ultrafast laser pulses, a pump that excites the material and a probe to observe changes induced by the pump. The pump-probe setup was designed to probe with whitelight spectrum (500-750nm) and to pump with near-infrared light (750-910nm), both pulses of sub-10 fs duration. Nanoporous gold and bi-layer samples showed altered optical properties at 550-700nm after pump induced, which is related to plasmonic effects that are not present in bulk films. They are also shown to have longer relaxation time when compared to bulk samples. Most of the measurement have been shown to be predictable when compared to articles with familiar research, except for nanoporous gold which showed an new phenomena with increased absorption.

Hilda Hultgren - Automatisk insamling och analys av diagnostiska standardnivåer inom radiologi – Östersunds sjukhus

Diagnostic reference levels (DRL) is a tool used by radiation safety authorities to monitor the use of radiation in health care. It can also be used as an optimization tool in radiology to reduce the radiation dose to the patient. In Sweden it is The Swedish Radiation Safety Authority (SSM) that decides the national DRL. At regular intervals, the hospitals submit their local DRL to SSM to verify that they are within the limits of the national DRL. In Region Jämtland Härjedalen, the collection of dose values is done manually which is time consuming, ineffectively and statistically limited. The aim with this master thesis is to automate the collection, analysis and presentation of the local DRL. The automation of the collection of data for the local DRL was done by extracting patients height and weight data from Sectra Data Warehouse (SDWH) and adding it to REMbox (Dicom Port) via the REST-API that the system has. From REMbox, data for the local DRL reports could be extracted and the reports were created in Python. For the analysis the weight range of adult patients who have undergone a CT-scan in Region Jämtland Härjedalen in 2024 was compared to the weight range that SSM uses for the national DRL. The radiation dose to the patient, Computed Tomography Dose Index (CTDIvol), as a function of Body Mass Index (BMI) was examined to see how the radiation dose was affected by BMI. The number of detected photons is given by the Beer-Lambert relation which means that the relationship between radiation dose and BMI should be exponential. The results of this master thesis show that 37% of the patients that have undergone a CT-scan were within the weight range that SSM uses for the national DRL. A method has also been developed for how to clean the data and get the exponential relationship between CTDIvol and BMI. Finally, an automation of the collection of data for the local DRL reports has been created.

Linn Mannelqvist - Classification for Nuclear Fuel Safety - Defect Detection in Sweden's Canister for Spent Nuclear Fuel – Uniper (Sydkraft Nuclear Power AB)

Since the 1960s, nuclear power has been produced in Sweden, and as early as 1999, a process of decommissioning and dismantling six of the country's twelve active nuclear reactors was initiated. To address the challenge of managing nuclear waste, a method known as KBS-3 has been developed. This method involves encapsulating the nuclear waste in a canister consisting of a cast iron insert for mechanical stability, and a copper shell to provide a corrosion barrier. The copper-clad canisters are then to be embedded in bentonite clay, 500 meters deep within the Swedish bedrock. In a future construction of this final repository, approximately 6,000 canisters will be manufactured, filled with spent nuclear fuel, sealed, and buried in the bedrock. The sealing of the canisters using the KBS-3 method will be carried out through friction stir welding. Currently, non-destructive testing of the welding process is performed using three techniques: ultrasound, eddy current testing, and radiography. Today, these techniques are used to analyze how to avoid defective weld zones. Ensuring that the weld areas are free from significant defects will be a critical aspect of a future canister production, as this will prevent the risk of nuclear waste leaking into the environment, which could pose a threat to human health and ecosystems. At present, the analysis of weld defects is conducted manually by inspecting one image at a time. For a future production setting, there is a need to streamline this manual inspection process through more efficient methods. This project presents an analysis of effective machine learning methods for defect detection as a solution to this problem. Four focus areas for detecting weld defects in X-ray images have been explored. The focus areas have been multi-class and binary defect classification, anomaly detection, and real-time defect detection. Two model comparisons have been made in classification, where a simple CNN and a more complex CNN-based model structure have been investigated. These two models have in turn been compared in application on two classes (defective and non-defective), as well as four classes of weld defects (cracks, porosity, lack of penetration, and no defect). Furthermore, anomaly detection using an Autoencoder model, and real-time defect detection using a pre-trained YOLO model has been explored. The results of this project presents a set of machine learning models that can obtain high accuracy test results, and therefore have good reasons to be considered and further developed in a production context in the future.