**十一、研究計畫中英文摘要：**請就本計畫要點作一概述，並依本計畫性質自訂關鍵詞。

1. 計畫中文摘要。（五百字以內）

由於半導體產業在現今生活中扮演相當重要的角色，許多生活用品皆會使用半導體晶片造就許多便利功能使人們滿足便利性的需求。也因為需求量的增加，半導體公司須因應如何使晶片生產效率最佳化以達到供給需求的平衡。所以半導體公司對於生產的產品必須進行嚴格的把關，除了對產品品質的要求，還有對產品生產效率的要求等。近年來透過數位轉型將 AI 和 5G 通訊應用在半導體公司的製造上，因此導入智動化(SmartAuto)改善一般自動化生產的效能不足，使得產能可以大幅提升。然而偶發性的產品瑕疵總是造成廠商巨大的財產損失，於是結合深度學習和邊緣計算的NVIDIA嵌入式平台可以解決所遭遇的問題，所以提出「基於數據驅動元強化學習的應用服務之計算資源異常偵測與預測」乙案。

本研究目的是分別提出 (1) 基於強化學習的伺服器異常檢測，透過深度強化學習檢測雲端服務異常，減少因停機造成的成本損耗、(2) 元強化學習的自適應框架，使用元強化學習快速適應機制減少在現預測模型重新佈署的成本以及(3) 基於元策略流程的主動異常檢測系統，以少量人力輔助協助訓練異常檢測模型，增加檢測的準確度。利用以上三項的數據驅動檢測系統解決方案，以三年期程解決台灣恩智浦公司在生產過程所遭遇的棘手問題。

本案的目標是為了解決在台灣恩智浦半導體股份有限公司(NXP)雲端應用服務常有非預期的停機與故障，導致生產進度延宕。因此提出「基於數據驅動元強化學習的應用服務之計算資源異常偵測與預測之研究」作為解決方案。本研究分做三年期程進行，第一年期程使用深度強化學習檢測雲端應用服務的時間序列異常，即時通報管理者以確保服務穩定運行。而第二年期程加入模型的快速適應框架，減少在線預測模型更新成本。在第三年期程建立一個以元策略為主的主動異常檢測系統，以人類專家適度加入模型訓練流程增加模型的有效性。冀望透過這三年期程執行計畫可達成本案的目標。

關鍵字：智動化、深度學習、監督式學習、Jetson Nano、Jetson Xavier NX、即時物件偵測、影像辨識、卷積型自動編碼器、YOLOv5、M3-YOLOv5、GSEH-YOLOv5、FGHSE-YOLOv5。

計畫概述:

本計畫與台灣恩智浦公司(NXP)合作進行三年期的改善製造方案。第一年以物件偵測演算法M3-YOLOv5分類出損壞晶片，經過工作人員再次確認為損壞晶片後即時停止機台排除狀況，大幅減少因工作人員未能立刻察覺損壞晶片而並未停機帶來的冗餘成本。第二年以物件偵測演算法FGHSE -YOLOv5的理論實務基礎下改良演算法得到更好的效能來檢測晶圓成品是否有瑕疵的出現。以AOI自動光學檢測的方式，大幅提升晶圓的供應效率及良率。第三年以物件偵測演算法GSEH-YOLOv5分類出晶圓切割側面是否有刮痕出現，使用輕量化架構進行AOI自動光學檢測取代人力，加速生產流程之運行。

**十一、研究計畫中英文摘要：**請就本計畫要點作一概述，並依本計畫性質自訂關鍵詞。

(二) 計畫英文摘要。（五百字以內）

Since the semiconductor industry plays a very important role in today's life, many daily necessities use semiconductor chips to create many convenient functions so that people can meet the needs of convenience. Also because of the increase in demand, semiconductor companies must respond to how to optimize wafer production efficiency to achieve a balance of supply and demand. Therefore, semiconductor companies must strictly control the products they produce. In addition to the requirements for product quality, there are also requirements for product production efficiency. In recent years, AI and 5G communications have been applied to the manufacturing of semiconductor companies through digital transformation. Thus, “SmartAuto” has been introduced to improve the performance of general automated production, which can greatly increase production capacity. However, occasional product defects always cause huge property losses for manufacturers. Combining deep learning and edge computing with NVIDIA embedded platforms can solve the problems encountered. Therefore, we proposed a project “intelligent real-time chip contour and wafer defect and its side scratching”.

The purpose of this research is to separately propose (1) chip appearance contour detection and intelligent system based on real-time image sensing and recognition, and after the staff reconfirms that the chip is damaged, immediately stop the machine to eliminate the condition, which can greatly reduce the problem caused by the staff. Failure to immediately detect the cost of redundancy caused by damaged chips without downtime, (2) intelligent wafer map defect type classification detection, which can greatly improve wafer supply efficiency and yield, and (3) intelligent Scratch detection on the side of the wafer does not require manpower to inspect the finished product, which causes a lot of time cost and visual fatigue due to long-term inspection, which affects the accuracy of inspection. Using the above three intelligent real-time detection system solutions to solve the thorny problems encountered by Taiwan NXP in the production process in a three-year period.

The goal of this case is to solve the slow production efficiency in the process of NXP Semiconductors Co., Ltd. (NXP) in Taiwan from wafer to wafer, which involves traditional human product quality inspection. "Detection system for flaws and side scratches" is the solution. This research is divided into a three-year period. In the first year, the embedded platform NVIDIA Jetson Nano is deployed and the improved M3-YOLOv5 object detection algorithm establishs a high-efficiency intelligent chip contour detection system to reduced the unexpected downtime. In the second year, the embedded platform NVIDIA Jetson Xavier NX will be deployed and an intelligent wafer map defect type classification inspection system established with an improved FGHSE-YOLOv5 object detection algorithm is introduced to ensure the quality of wafers. Deploy the embedded platform NVIDIA Jetson Xavier NX in the third year and introduce an intelligent wafer side scratch detection system based on the improved GSEH-YOLOv5 object detection algorithm to detect whether the cut surface is scratched through object detection The method of mark generation replaces manpower and accelerates the operation of the production process. Hopefully, the goal of this three-year project can be achieved.

**Keywords:** SmartAuto, Deep Learning, Supervised Learning, Jetson Nano, Jetson Xavier NX, Real-Time Object Detection, Image Recognition, Convolutional Autoencoder, YOLOv5, M3-YOLOv5, GSEH-YOLOv5, and FGHSE-YOLOv5.