**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）

雲端應用服務是目前各種產業提供服務的主要媒介，它的彈性佈署與存取服務的方便性吸引了許多用戶。半導體公司也透過雲端服務分析生產線產品資料，提供有關部門即時存取與分析。近年晶片設計工法提升，一個生產週期將生成大量資料需要儲存，因此一個雲端服務的穩定運行是至關重要的問題，若運行時意外終止將會造成高額損失。於是結合元強化學習的雲端應用服務異常檢測技術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：雲端應用服務、非預期故障、強化學習、元強化學習、主動異常檢測、模型自適應。

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。第一年以強化學習模型檢測雲端服務發生的異常狀態，當系統發現異常即時通知工作人員處理。第二年以元強化學習演算法減少更新在線預測模型的訓練成本，以MAML訓練框架使得模型能快速適應新資料，大幅減少額外訓練的成本。第三年以一種基於反饋的主動異常檢測方法提升模型的精確度，由分析師參與模型訓練流程，模型透過反饋更新模型參數提升檢測的準確性。

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(二) 計畫英文摘要。（五百字以內）

Cloud application service is the primary medium for various industries to provide services, and its flexible deployment and convenience of accessing services attract many users. Semiconductor companies also analyze product data of production lines through cloud services to provide relevant departments with instant access and analysis. In recent years, with the improvement of chip design methods, a large amount of data will be generated in a production cycle and need to be stored. Therefore, the stable operation of a cloud service is a critical issue. The operation terminated unexpectedly will cause high loss. Therefore, the anomaly detection technology of cloud application services combined with meta-reinforcement learning can solve the problems encountered, so we propose the " Abnormal Detection and Prediction of Computing Resources for Application Services Based on Data-Driven Meta-Reinforcement Learning. "

The purpose of this research is to propose (1) server anomaly detection based on reinforcement learning to detect cloud service exceptions through deep reinforcement learning to reduce the cost loss caused by downtime, (2) an adaptive framework of meta-reinforcement learning, use meta reinforcement learning fast adaptation mechanism to reduce the cost of redeployment of current online prediction models, and (3) active anomaly detection system based on meta-strategy process, establish an active anomaly detection system based on meta-strategy in the third year, and add human experts to the model training process to increase the effectiveness of the model Use the above three data-driven detection system solutions to solve the thorny problems encountered by Taiwan NXP in the production process in three years.

This case aims to solve the unexpected shutdowns and failures of cloud application services in Taiwan NXP Semiconductors Co., Ltd. (NXP), which lead to delays in production schedules. Therefore, "Research on Abnormal Detection and Prediction of Computing Resources Based on Data-Driven Meta-Reinforcement Learning for Application Services" is proposed as a solution. This research divide into three years. In the first year, we use deep reinforcement learning to detect time series anomalies of cloud application services, and notify the managers immediately to ensure the stable operation of the services. In the second year, the rapid adaptation framework of the model is added to reduce the cost of updating the online prediction model. In the third year, we will design an active anomaly detection system based on meta-strategy. Human experts will add to the model training process to increase the model's effectiveness. It is hoped that the goal of this project can be achieved through the implementation of the three-year plan.

**Keywords:** Cloud application services, Unexpected failures, Reinforcement learning, Meta reinforcement learning, Active anomaly detection, Self-adaptive modeling.