CHAPTER 2
TASK CLASSIFICATION IN EDGE-CLOUD

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2.1 INTRODUCTION

Edge-cloud continuum computing is a significant technological advancement that brings cloud computing to the network edge together (Gabi et al., 2022). The technology reduces latency, improves data privacy, and speeds up critical applications. Resource efficiency is essential to maximise edge-cloud computing's potential. This context relies on task classification to allocate resources according to task characteristics and needs, improving resource efficiency (Abdullahi et al., 2023).

A central research area in edge cloud computing is task classification based on characteristics and requirements. Resource allocation optimisation and system performance in edge cloud environments depend on this classification process. Task classification organises computing tasks by characteristics, resource needs, and importance. Edge cloud computing tasks range from simple data processing to complex machine learning algorithms. Therefore, task classification makes it possible to allocate resources so that each task uses the right ones.

Edge-cloud environments often have resource heterogeneity. This implies that edge devices and servers have different computational, memory, and network bandwidths. Task classification helps match tasks

with the best edge resources, improving performance and reducing resource inefficiency. Edge computing also benefits autonomous vehicles and real-time internet of thinking (IoT) data processing (Arezki & Fizazi, 2021). Task classification involves distinguishing between low-latency and high-latency tasks. Edge cloud systems prioritise low-latency tasks to improve user experience. The system quickly categorises incoming tasks to adapt to workload changes (Schäfer et al., 2018). System flexibility ensures resource optimisation to meet edge application needs. Thus, this study introduces a task classification scheme using a flower pollination algorithm and support vector machine in the edge-cloud continuum.

2.1.1 Cloud Computing

Cloud computing is a cornerstone of modern IT infrastructure, offering services catering to diverse business needs. At its core, cloud computing encompasses three distinct service models: Infrastructure as a service (IaaS), platform as a service (PaaS), and software as a service (SaaS) (Abdullahi et al., 2019). Each model provides unique capabilities and benefits, enabling organisations to leverage cloud resources according to their requirements and preferences.

Infrastructure as a service (IaaS) represents the foundational layer of cloud computing, offering virtualised computing resources over the internet. With IaaS, businesses can access and provision essential IT infrastructure components such as virtual machines, storage, and networking on a pay-as-you-go basis (Abdullahi et al., 2019). This model eliminates the need for organisations to invest in physical hardware and infrastructure, allowing them to scale resources dynamically based on demand. IaaS providers deliver high flexibility and control, empowering users to customise and manage their virtualised environments according to their specific requirements. Examples of IaaS providers include Amazon Web Services (AWS), Microsoft Azure, and Google Cloud Platform (GCP).

The PaaS builds upon the foundation laid by IaaS, offering a comprehensive development and deployment platform for building, testing, and managing applications (Abdullahi et al., 2019). PaaS providers deliver a complete software development environment, including tools, frameworks, and runtime environments, abstracting away the underlying infrastructure complexities. This enables developers to focus on coding and innovation without worrying about infrastructure management tasks such as provisioning servers or configuring networking. PaaS facilitates rapid application development and deployment, streamlining the software development lifecycle and fostering collaboration among development teams. Popular PaaS offerings include Microsoft Azure App Service, Google App Engine, and Heroku.

The SaaS represents the highest layer of abstraction in cloud computing, delivering fully functional applications over the internet on a subscription basis. SaaS applications are hosted and managed by third-party providers, who handle maintenance, updates, and support, relieving users of the burden of software installation and management (Usman et al., 2022). SaaS offerings span various business applications, including productivity tools, customer relationship management (CRM) systems, enterprise resource planning (ERP) solutions, and collaboration platforms. By leveraging SaaS, organisations can access enterprise-grade software without upfront investment in software licenses or infrastructure. Leading SaaS providers include Salesforce, Microsoft Office 365, and Google Workspace.

The evolution of cloud computing has ushered in a new era of IT innovation and agility, fuelled by the convergence of IaaS, PaaS, and SaaS. These three service models offer organisations unprecedented flexibility, scalability, and efficiency, empowering them to accelerate digital transformation initiatives and drive business growth. However, the limitations of cloud computing, including latency, bandwidth constraints, data privacy concerns, offline operation requirements, and scalability/cost considerations, have driven the adoption of edge computing as a decentralised computing paradigm. By extending