# Forensic Analysis of Stable Diffusion on Windows

Degree programme :

This Master Thesis explores the forensic effects of Stable Diffusion, an advanced AI tool capable of generating highly realistic pictures, on Windows 10 and Windows 11 systems. The research focuses on identifying digital artefacts that Stable Diffusion leaves behind and developing methodologies for their detection and analysis. This study addresses a significant gap in current forensic practices and the handbook provides crucial insights for law enforcement.

## Context

The rapid advancement of artificial intelligence technologies, especially generative models like Stable Diffusion which are capable of producing highly realistic pictures, mean new challenges for digital forensics analysis. These models can be used to generate pictures with illicit content. This thesis addresses the urgent need for advanced forensic techniques that can keep pace with the sophisticated apabilities of AI-driven applications.

## Goal

This research aims to develop robust forensic methodologies that can effectively identify and analyse digital artefacts produced by Stable Diffusion on Windows 10 and Windows 11 systems. The goal is to enhance the tools available to law enforcement agencies, enabling them to perform more thorough investigations into AI-generated content and ensuring that digital forensics can keep pace with technological advancements.

## Methodology

The study employed a comprehensive forensic approach, utilising both systematic analysis and software forensics tools to examine digital traces left by Stable Diffusion. Key areas of focus included the analysis of file systems, operating systems, application data, memory, and network traffic. Special emphasis was placed on identifying unique digital artefacts that could be directly attributed to the operation of Stable Diffusion. The research methodology was designed to be replicable and scalable, ensuring that findings could be applied across various law enforcement contexts.

## Result

While specific findings are subject to a non-disclosure agreement and cannot be detailed in this publication, the research successfully established a series of methodologies that significantly enhance the forensic investigation of AI-generated pictures. These methodologies are capable of identifying unique patterns and traces left by Stable Diffusion, providing law enforcement with new tools to tackle the challenges posed by digital content generation technologies. The implications of these methodologies are profound, offering potential for broader application and setting a foundation for future forensic advancements.

Manuela Llamera
MAS Digital Forensics & Cyber Investigation