Warlock-Studio

– User Manual & Technical Documentation –

Version 3.0

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Abstract

This document is a comprehensive technical guide for Warlock-Studio 3.0. The information has been validated and enriched with a deep analysis of the source code to provide precise details about its architecture, an advanced optimization guide, and a robust troubleshooting manual.

Contents

1. Introduction

Warlock-Studio is an AI-powered media enhancement and upscaling suite, designed to deliver high-quality results through an accessible user interface. Version 3.0 introduces key enhancements in GPU management, error handling, and performance efficiency. It solidifies its position as a powerful tool for professional content creators.

1.1. What's New in Version 3.0

The latest version brings the following key enhancements:

- **Enhanced AI Model Support:** New state-of-the-art models like Real-ESRGAN, RIFE, and GFPGAN have been integrated for superior upscaling and interpolation.

- **Advanced GPU Management:** Improved error handling optimizes performance even in lower VRAM configurations.

- **Optimized Memory Management:** Includes proactive memory optimization techniques and better threading support for smooth processing.

- **Improved GUI and User Preferences:** A more user-friendly interface with enhanced configuration options and dynamic real-time updates.

- **Enhanced Video Encoding:** Supports multiple hardware-accelerated encoders from NVIDIA, AMD, and Intel for optimal performance.

1.2. Main Features

- **AI Upscaling:** Uses state-of-the-art models like Real-ESRGAN, BSRGAN, and SRVGGNet-Compact.

- **Frame Interpolation:** Increases FPS or creates smooth slow-motion effects using RIFE models.

- **Noise Reduction:** Includes dedicated IRCNN models for cleaning images and videos.

- **Face Restoration:** GFPGAN model for enhancing and restoring faces in photos.

- **Hardware Acceleration:** Uses the ONNX Runtime engine with the DirectML provider (`DmlExecutionProvider`) for GPU acceleration compatible with DirectX 12.

- **Advanced Video Encoding:** Supports hardware-accelerated encoders from NVIDIA (NVENC), AMD (AMF), and Intel (QSV).

2. Installation and Program Architecture

2.1. System Requirements

Component	Requirement
Operating System	Windows 10 (64-bit) or later
RAM	8 GB (Minimum), 16 GB (Recommended)
Graphics Card (GPU)	**DirectX 12** compatible. **Recommended: 4+ GB VRAM**.
Storage	2 GB of free space. An SSD is recommended for better performance.

Table 1: Hardware and software requirements for Warlock-Studio 3.0.

2.2. File Structure and Dependencies

> Warlock-Studio is a self-contained application. The following components are included in the installation and require no action from the user.

- `ffmpeg.exe:` Located in the `Assets` folder, it is the engine for all video manipulation, encoding, and decoding.

- `exiftool.exe:` Also in `Assets`, it is used to read and write metadata (EXIF, XMP), ensuring that the original file information is preserved.

- **AI Models:** The models in `.onnx` format are located in the `AI-onnx` folder.

- **User Preferences:** A file named

3. Detailed Guide to AI Models

The choice of AI model is the most important factor for quality and processing time.

3.1. Model Comparison Table

The following table details the relative VRAM usage of each model.

Model	Main Function	Scale	VRAM Weight	Recommended Use Case
Denoising Models				
IRCNN_Mx1	Denoise	x1	4.0	Moderate noise.
IRCNN_Lx1	Denoise	x1	4.0	Intense noise.
High-Quality Upscaling Models (Slow)				
BSRGANx4	Upscale	x4	0.6	Realistic photos. Excellent fine detail.
BSRGANx2	Upscale	x2	0.7	Similar to x4 but for a smaller upscale.
RealESRGANx4	Upscale	x4	0.6	General purpose, good for textures.
RealESRNetx4	Upscale	x4	2.2	Alternative to RealESRGAN, can be faster.
High-Speed Upscaling Models (Lightweight)				
RealESR_Gx4	Upscale	x4	2.2	Fast upscaling, ideal for videos.
RealESR_Animex4	Upscale	x4	2.2	Optimized for anime and cartoons.
Face Restoration Models				
GFPGAN	Restore	x1	1.8	Face enhancement and restoration.
Frame Interpolation Models (Video Only)				
RIFE	Interpolate	N/A	N/A	Maximum interpolation quality.
RIFE_Lite	Interpolate	N/A	N/A	Faster version, ideal for GPUs with < 4 GB VRAM.

Table 2: Guide to AI model selection and their impact on VRAM.

4.   Configuration and Performance Optimization

4.1.   Critical Performance Parameters

- **Input Resolution %:** The most effective adjustment for speed. It reduces the resolution before processing it with AI. A value between **50% and 75%** is usually ideal.

- **GPU VRAM Limiter (GB):** Define your GPU's VRAM. It is used to calculate the size of the processing *tiles* and prevent memory errors.

- **AI Multithreading:** For videos only. It processes multiple frames in parallel, speeding up the process but consuming more VRAM and CPU.

- **AI Blending:** Blends the original image with the processed image. Useful for reducing artifacts when using a low *Input Resolution*.

- **Frame Generation:** For RIFE models, allows creating interpolated frames for higher FPS or slow-motion effects.

4.2.   The User Preferences File

The

$\texttt{Warlock-Studio}_3.0_U serPreference.json\ filesavesyoursettings.$

5.   Advanced Troubleshooting Guide

> ⚠ **Warning**
>
> The **Number 1** cause of errors is **special characters** in file paths and names. Avoid using: `', ", @, #, $, %, &, *, [, ], ?, etc.`.

🚫 **Error: "FFmpeg encoding failed: Invalid argument"**
   Cause: Invalid file name or path. **Solution:** Rename the file and/or its containing folder, removing any special characters.

🖳 **Error: "out of memory" or unexpected crash**
   Cause: The GPU ran out of video memory (VRAM). **Solution:**

1. Lower the **VRAM Limiter** to a value equal to or less than your GPU's actual VRAM.
2. Lower the **Input Resolution %** to 75% or less.
3. For videos, decrease the **AI Multithreading** threads or turn it "OFF".
4. The application will try to recover from this error automatically.

Error: "cannot convert float NaN to integer"
   Cause: GPU driver timeout, often due to overload or overheating. **Solution:** Restart the process **without deleting the generated frames folder**. The application will read the existing frames and resume work from where it failed.

🔇 **Issue: Output video has no audio**
   Cause: The original video had no audio track, a *Slowmotion* mode was used, or the audio codec was incompatible. **Solution:** The program first tries to copy the audio stream directly. If that fails, it tries to re-encode to AAC. If all fails, it saves the video without audio. Using the `.mkv` container for the output may help.

❷ **Issue: Application won't open or closes on startup**

    Cause: Corrupt settings, lack of permissions, or an environment error. **Solution:**

1. Go to your **Documents** folder and delete the

⚠ **Issue: Frame interpolation not working**

    Cause: RIFE models are not selected or incompatible video format. **Solution:** Ensure you have selected a RIFE model (RIFE or RIFE_Lite) and that the frame generation option is properly configured.

6.   Advanced Architecture and Processes

6.1.   Inference Engine and Hardware Acceleration

Warlock-Studio uses **ONNX Runtime** with the **DirectML** provider (`DmlExecutionProvider`). This translates AI operations into **DirectX 12** calls, ensuring broad compatibility with NVIDIA, AMD, and Intel GPUs.

6.2.   Tiling System and Memory Management

To handle high-resolution files, the application splits each frame into fragments (*tiles*). The size of these tiles is dynamically calculated using the **VRAM Limiter**. Additionally, Python's garbage collector (`gc.collect()`) is invoked to force memory release and ensure stability.

6.3.   Resume and Checkpoint Functionality

If a video process is interrupted, the processed frames are saved. When restarting the task, the `check_video_upscaling_resume` function detects these files and resumes work from where it left off, saving time.

6.4.   Asynchronous Frame Writing

During video upscaling, the frames processed by the GPU are sent to a separate writer thread. This allows the GPU to immediately start processing the next batch without waiting for the (slower) disk writing operation to finish, thus maximizing performance.

6.5.   Frame Interpolation Pipeline

The RIFE models use a specialized interpolation pipeline that analyzes motion between frames to generate smooth intermediate frames. This enables higher frame rates or slow-motion effects with minimal artifacts.