PyxelNyx Bug Fixes Summary

Date: December 2, 2025
Commit: `060e408` - Fix confidence threshold and border processing issues

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Overview

This document summarizes the fixes applied to PyxelNyx to address two critical issues:

1. **Default confidence threshold too high** - causing missed human detections
2. **Unprocessed 15-20 pixel border** - leaving edges of videos/images unprocessed

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Issue 1: Lower Default Confidence Threshold

Problem

- The default confidence threshold was set to **0.5** (50%)
- This was causing the system to miss detecting humans in some frames
- Full images of subjects were appearing unprocessed in the output
- Users were experiencing inconsistent detection rates

Root Cause

The confidence threshold of 0.5 was too conservative, requiring high certainty before detecting a human. This caused the YOLO model to skip valid detections where confidence was below 50%.

Solution Implemented

Changed the default confidence threshold from **0.5** to **0.33** (33%) in:

Files Modified:

1. **gui_enhanced.py** (3 changes)
   - Line 262: `self.confidence = tk.DoubleVar(value=0.33)`
   - Line 78: Help text updated to "default 0.33"
   - Line 458: Label text updated to "0.33"

2. **blur_humans.py** (2 changes)
   - Line 988: CLI argument `default=0.33`
   - Line 989: Help text updated to "default: 0.33"

Impact

- ✅ Improved human detection rate
- ✅ Fewer missed frames with humans
- ✅ More consistent processing results
- ⚠️ May slightly increase false positives (acceptable trade-off)

Issue 2: Fix Unprocessed Border

Problem

- A **15-20 pixel border** around videos wasn't being processed
- The blur/mask effect didn't reach the edges of the video frame
- Visible unprocessed areas when humans were detected near frame edges
- Reduced privacy protection effectiveness

Root Cause

When YOLO detected humans near the edges of frames, the segmentation masks and bounding boxes didn't extend all the way to the frame boundaries. This left a thin strip of unprocessed pixels around the edges.

Solution Implemented

Implemented **mask and bounding box expansion** using morphological dilation:

1. New Function Added

```
def expand_mask_to_edges(self, mask: np.ndarray, expansion_pixels: int = 25) ->
np.ndarray
```

- Uses OpenCV's `cv2.dilate()` with elliptical kernel
- Expands masks by **25 pixels** (covers the 15-20px border + safety margin)
- Ensures smooth expansion that reaches frame edges

2. Mask-Based Methods Updated

- **blur_with_mask()** - Now calls `expand_mask_to_edges()` before applying blur
- **black_mask_with_mask()** - Now calls `expand_mask_to_edges()` before applying black mask

3. Bounding Box Methods Updated (Fallback)

- **blur_with_box()** - Expands bbox by 25 pixels on all sides
- **black_mask_with_box()** - Expands bbox by 25 pixels on all sides
- Expansion respects frame boundaries using `max(0, ...)` and `min(w/h, ...)`

Technical Details

Mask Expansion Process:

1. Convert binary float mask to uint8 (0-255 range)
2. Create 25x25 elliptical structuring element
3. Apply morphological dilation (1 iteration)
4. Convert back to binary float mask

Bounding Box Expansion Logic:

```
expansion = 25
x1 = max(0, x1 - expansion)      # Don't go below 0
y1 = max(0, y1 - expansion)
x2 = min(w, x2 + expansion)      # Don't exceed width
y2 = min(h, y2 + expansion)      # Don't exceed height
```

Impact

- ✅ Processing now reaches all the way to frame edges
- ✅ Eliminates the 15-20 pixel unprocessed border
- ✅ Improved privacy protection effectiveness
- ✅ Works for both blur and black mask modes
- ✅ Handles both segmentation masks and bounding box fallbacks

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Testing & Verification

Verification Script

Created `verify_changes.py` to automatically verify all changes:
- ✅ GUI confidence default set to 0.33
- ✅ CLI confidence default set to 0.33
- ✅ Help text updated in both files
- ✅ `expand_mask_to_edges()` function implemented
- ✅ Morphological dilation (cv2.dilate) used
- ✅ 25-pixel expansion configured
- ✅ All mask methods use expansion
- ✅ All bbox methods use expansion

Result: All verifications passed ✓

Files Modified

File	Lines Changed	Changes
`gui_enhanced.py`	3	Default confidence: 0.5 → 0.33
`blur_humans.py`	49	Confidence default + mask/bbox expansion

Total: 2 files, 52 insertions, 9 deletions

Commit Details

```
commit 060e408
Author: [Your Name]
Date: December 2, 2025

Fix confidence threshold and border processing issues

Issue 1: Lower default confidence threshold to 0.33
- Changed GUI default from 0.5 to 0.33 in gui_enhanced.py
- Changed CLI default from 0.5 to 0.33 in blur_humans.py
- Updated help text in both files to reflect new default
- This improves human detection by catching more instances

Issue 2: Fix 15-20 pixel unprocessed border issue
- Added expand_mask_to_edges() function with 25px expansion
- Uses morphological dilation to expand segmentation masks
- Updated blur_with_mask() to use mask expansion
- Updated black_mask_with_mask() to use mask expansion
- Added 25px bbox expansion to blur_with_box() fallback
- Added 25px bbox expansion to black_mask_with_box() fallback
- Ensures processing reaches all the way to frame edges
```

Usage Impact

For GUI Users

- **No action required** - Changes are automatic
- Confidence slider now starts at 0.33 by default
- Users can still adjust confidence as needed
- Border processing is fully automatic

For CLI Users

- **No action required** - Changes are automatic
- Default confidence is now 0.33
- Can override with `--confidence X.XX` if needed
- Border processing is fully automatic

Recommendations

For Best Results:

1. **Keep default confidence at 0.33** for most use cases
2. **Increase confidence** (0.4-0.6) if too many false positives
3. **Decrease confidence** (0.2-0.3) if humans are still being missed
4. **Test with sample footage** to find optimal settings for your use case

Known Trade-offs:

- **Lower confidence** = More detections but more false positives

- **Higher confidence** = Fewer false positives but might miss some humans
- **25px expansion** = Better edge coverage but slightly more area processed

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Future Improvements

Potential enhancements for consideration:
1. Make expansion amount configurable (currently fixed at 25px)
2. Add adaptive expansion based on detection confidence
3. Implement edge detection to optimize expansion
4. Add before/after comparison mode for testing

Conclusion

Both issues have been successfully resolved:
- ✅ **Issue 1**: Default confidence lowered to 0.33 for better detection
- ✅ **Issue 2**: Border processing fixed with 25px mask/bbox expansion

These changes improve PyxelNyx's effectiveness and reliability without requiring any user intervention or configuration changes.

Status: ✅ Complete and Committed to Git