

ATTENTION U-NET INTEGRATED WITH NOISE ANALYSIS FOR FORGERY SEGMENTATION IN INVOICE DOCUMENT IMAGES

Huỳnh Thiên Phước^{1,2}

¹ University of Information Technology, Ho Chi Minh City, Vietnam

² Vietnam National University, Ho Chi Minh City, Vietnam

What ?

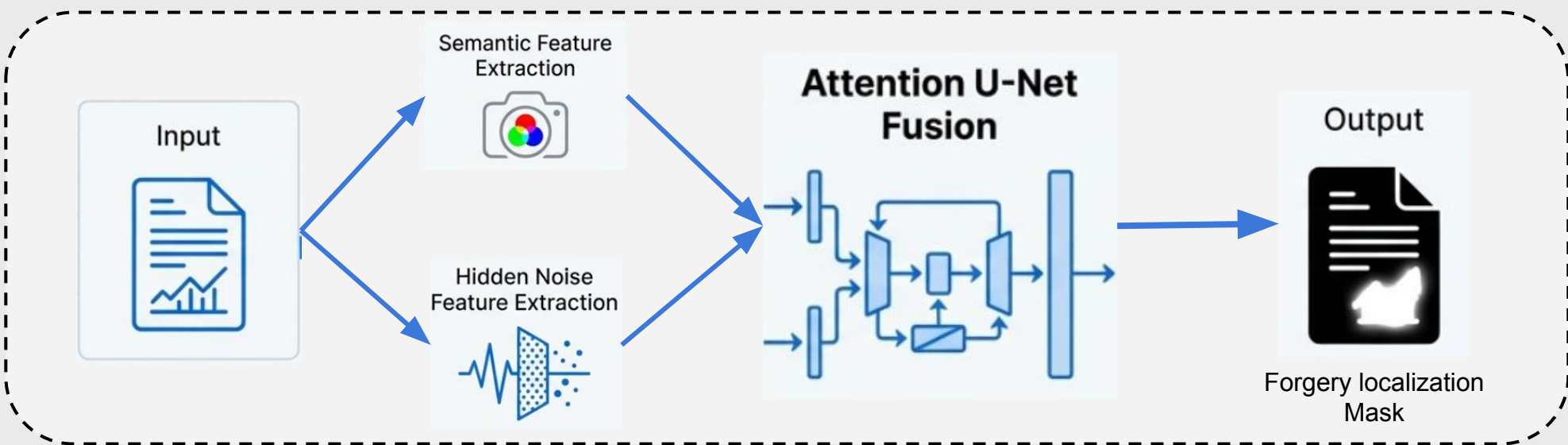
Automate the detection of manipulated administrative documents (invoices, receipts):

- **Targets:** Copy-pasting regions from other images, cloning areas within the same image, removing or altering text or numbers
- **Output:** A pixel-perfect binary mask highlighting the forged regions.

Why ?

- **Financial Risk:** Document fraud causes massive financial losses annually.
- **Invisible Traces:** Modern editing tools create manipulations undetectable by the human eye.
- **Technical Challenge:** Standard CNNs struggle to distinguish subtle *tampering artifacts* from the document's natural *paper texture* and noise.

Overview



Description

1. Semantic feature extraction

Input Processing: The Encoder network processes the raw RGB document image.

Context Learning: Extracts high-level spatial features to understand document structure, text layout, and global context.

Role: Provides the "semantic map" identifying *what* the document contains.

2. Hidden noise feature extraction

Artifact Detection: Applies high-pass filters to suppress visual content (text/logos).

Invisible Traces: Reveals subtle, invisible anomalies like compression artifacts and resampling traces.

Role: Highlights *inconsistencies* in the noise distribution that indicate tampering.

3. Attention U-Net Fusion

Smart Integration: Fuses semantic and noise features within the U-Net Decoder.

Attention Gates: Act as dynamic filters at skip connections to suppress irrelevant background signals (paper texture).

Precision: Focuses the model on **boundary artifacts**, generating a precise binary mask of the forged regions.

4. Potential applications

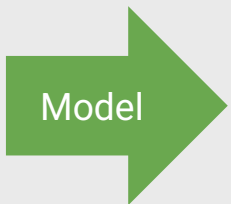
Automated expense reporting

Insurance claim processing

Enhance e-KYC process

Digital document forensics

Company Name		COMMERCIAL INVOICE	
Other Company 133 Company Street Karian, NA 65126 E-mail: mvinm@gmail.com		Tonore: 0082366 Commercial AC30050 TN9/6/787/22	
Vendor Information		Vendor Information	
Vendery Nom 125 Loheny Street Commerella, NX 25115 Phone: 335 6864	Condary: Besonarve: Cost:	Company Matrinsam 00233	
Item Description	Quantity	Unit Price	Total
One plated provates hroscrest	1	\$30.00	\$150.00
Subscribed inovatore otks mast	1	\$19.00	\$158.00
Resert the ment brshere mauertibes	1	\$20.00	\$50.00
Resers snape of Item	1	\$10.00	\$36.00
		Subtotal	\$394.00
		TOTAL AMOUNT DUE	\$2,135.00
Description: A forgery designed to be undetectable by the human eye.			
Source Sans Pro: Source Sans Pro 412345			



Company Name		COMMERCIAL INVOICE	
Other Company 133 Company Street Karian, NA 65126 E-mail: mvinm@gmail.com		Tonore: 0082366 Commercial AC30050 TN9/6/787/22	
Vendor Information		Vendor Information	
Vendery Nom 125 Loheny Street Commerella, NX 25115 Phone: 335 6864	Condary: Besonarve: Cost:	Company Matrinsam 00233	
Item Description	Quantity	Unit Price	Total
One plated provates hroscrest	1	\$30.00	\$150.00
Subscribed inovatore otks mast	1	\$19.00	\$158.00
Resert the ment brshere mauertibes	1	\$20.00	\$50.00
Resers snape of Item	1	\$10.00	\$36.00
		Subtotal	\$394.00
		TOTAL AMOUNT DUE	\$2,135.00
Description: A forgery designed to be undetectable by the human eye.			
Source Sans Pro: Source Sans Pro 412345			