Information Extraction from Courier Package Images

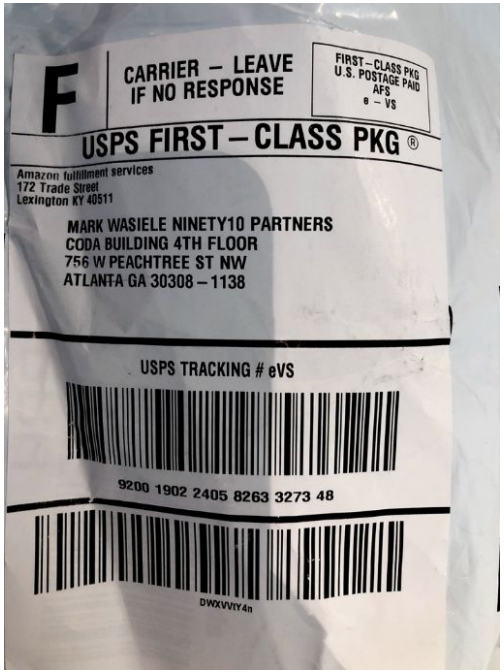
Zaryab Muhammad Akram
BSCS - NUST SEECS

Problem Description

- Extract Information from Package Label Images
- Differentiate between Sender/ Receiver Information
- Extract other information: Courier Name, Package Weight/ Dimensions etc.

Dataset Description

- Total Entities: **16**
- Separate Sender/ Receiver Entities: **27**



Approach Used

1. Single Step Approach

- Named Entity Recognition on Full Label Text

2. Two Step Approach

- Localizing Sender and Receiver Regions using a Detection Model
- Named Entity Recognition on Text from detected region

Single Step Approach

Single Step Approach

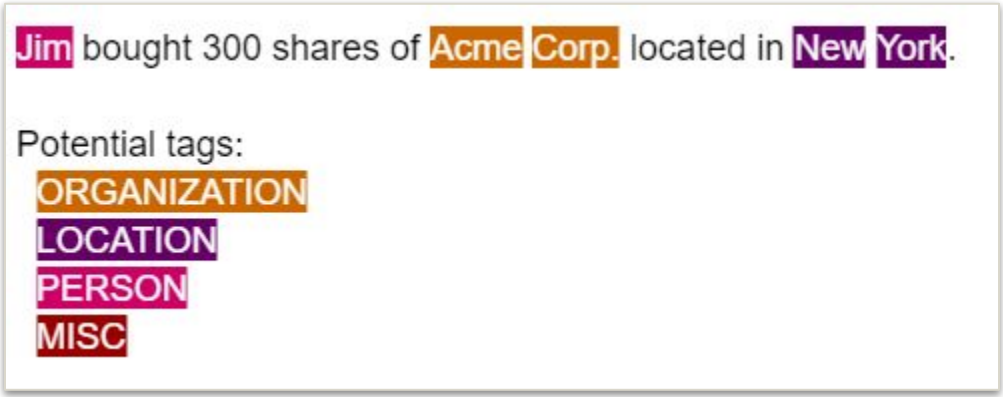
Google OCR (Cloud Vision)

Named Entity Recognition

Named Entity Recognition

Problem Description

- Information Extraction Task
- Locate and Classify entities in text



Named Entity Recognition

Approach

- **CNN-BiLSTM-CRF** model used

Convolutional Neural Network (CNN)

- extracts character level features

Bi-directional Long-Short Term Memory (Bi-LSTM)

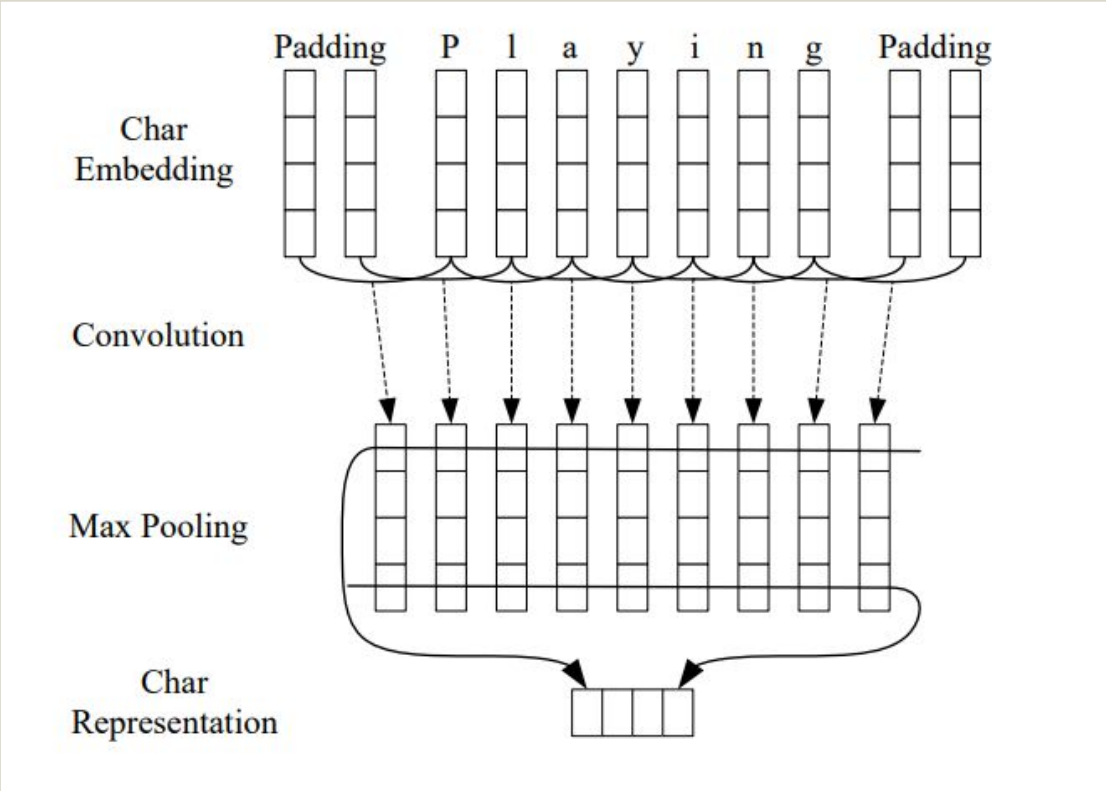
- captures long distance dependencies

Conditional Random Field (CRF)

- considers the correlations between neighboring labels

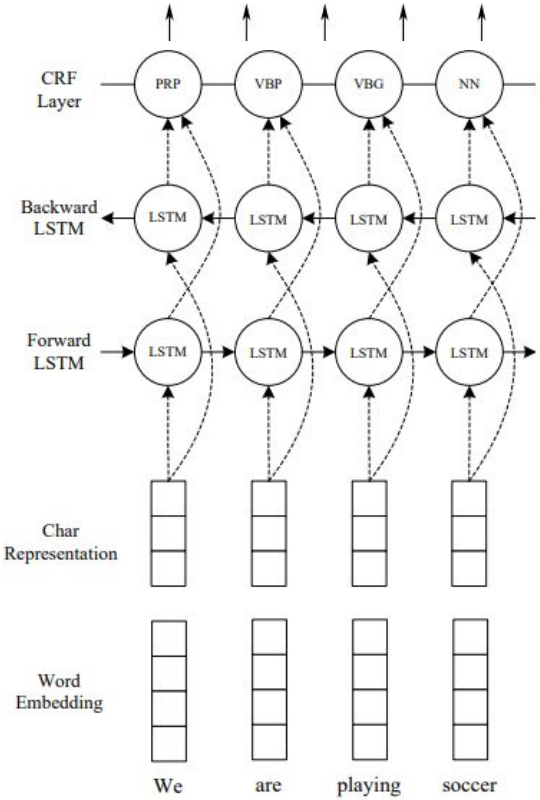
Named Entity Recognition

Extracting Character Representations



Named Entity Recognition

Complete Model



Named Entity Recognition

Tagging Scheme Used

1. BIOES Tagging 
2. IO Tagging 

Alex	S-PER
is	O
going	O
to	O
Black	B-LOC
River	I-LOC
Falls	E-LOC

BIOES Tagging

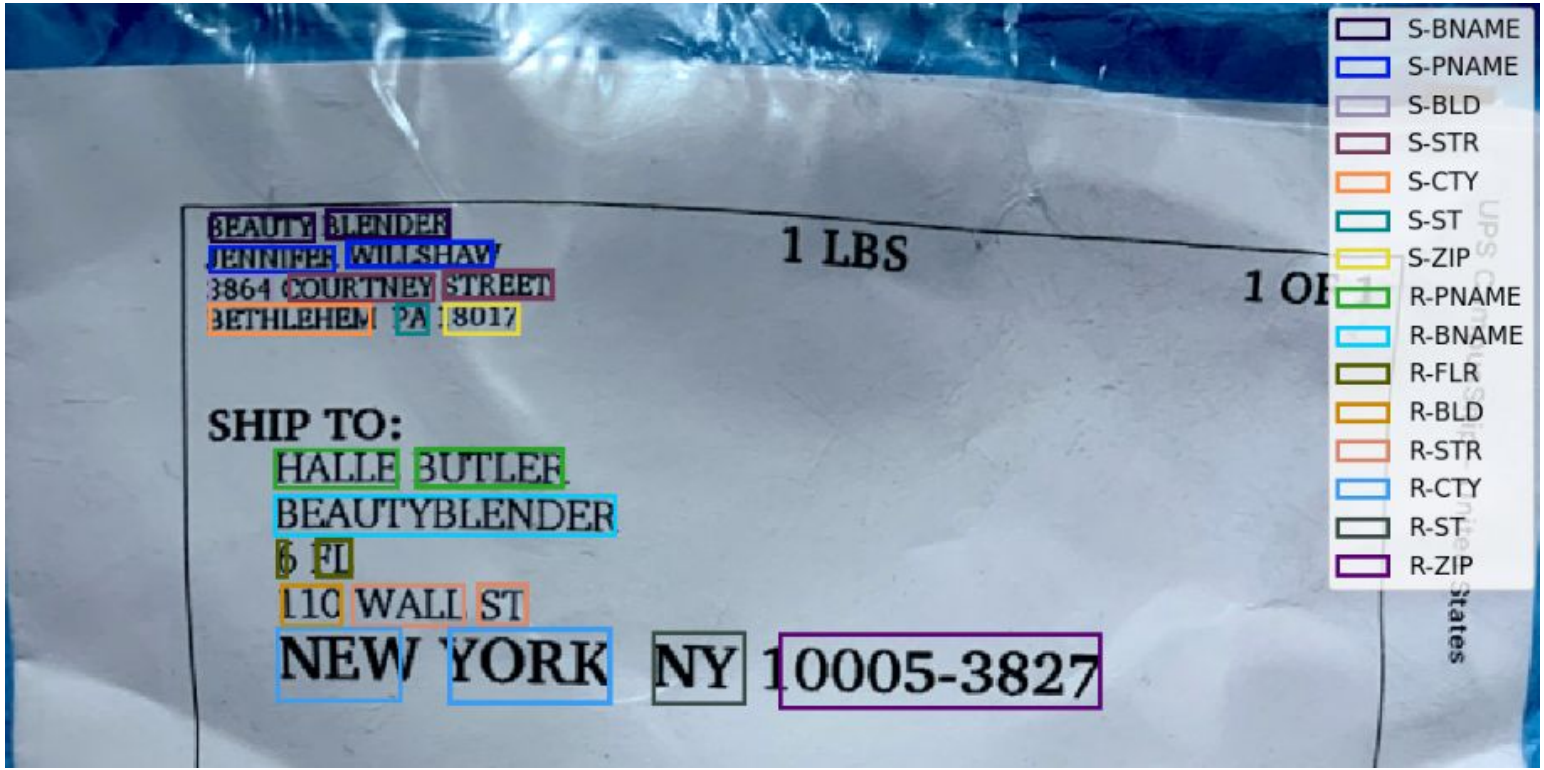
Single Step Approach

Model Evaluation

	precision	recall	f1-score	support
CNAME	0.74	0.90	0.81	77
DIM	1.00	0.71	0.83	17
O	0.95	0.91	0.93	4369
R-BLD	0.85	0.92	0.88	110
R-BNAME	0.78	0.74	0.76	239
R-CTRY	0.76	0.83	0.79	41
R-CTY	0.88	0.96	0.92	205
R-FLR	0.83	0.91	0.87	114
R-ONUM	0.70	0.84	0.76	25
R-PNAME	0.83	0.93	0.87	179
R-ST	0.90	0.95	0.93	151
R-STR	0.88	0.92	0.90	223
R-TEL	0.67	0.82	0.74	89
R-ZIP	0.91	0.96	0.93	172
S-BLD	0.70	0.95	0.81	62
S-BNAME	0.73	0.71	0.72	156
S-CTRY	0.85	0.86	0.85	65
S-CTY	0.76	0.89	0.82	91
S-FLR	0.67	0.67	0.67	6
S-ONUM	0.73	0.69	0.71	16
S-PNAME	0.88	0.83	0.85	42
S-ST	0.78	0.86	0.81	69
S-STR	0.83	0.90	0.86	143
S-TEL	0.83	0.81	0.82	86
S-ZIP	0.87	0.94	0.90	80
SHP	0.74	0.87	0.80	84
TRK	0.88	0.98	0.93	433
WGHT	0.81	0.76	0.78	220
accuracy			0.90	7564
macro avg	0.81	0.86	0.83	7564
ghted avg	0.90	0.90	0.90	7564

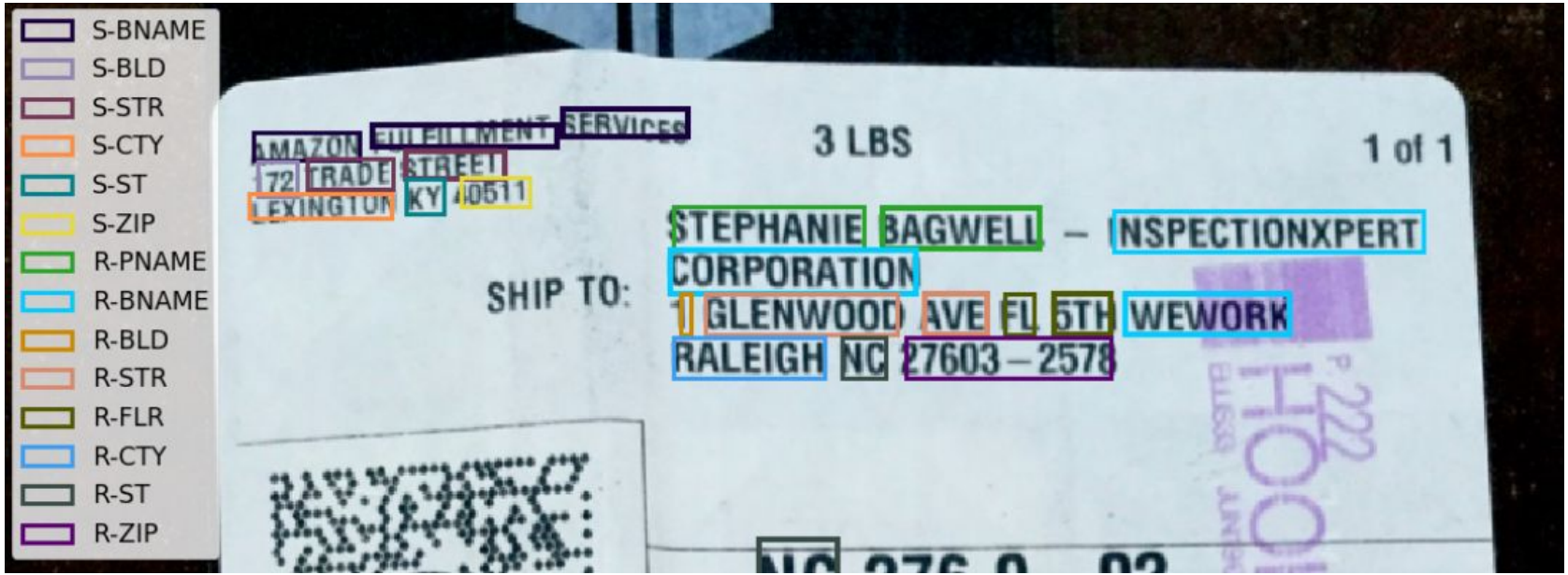
Single Step Approach

Model Prediction



Single Step Approach

Model Prediction



Two Step Approach

Two Step Approach

Region Localization (Mask RCNN)

Google OCR (Cloud Vision)

Named Entity Recognition

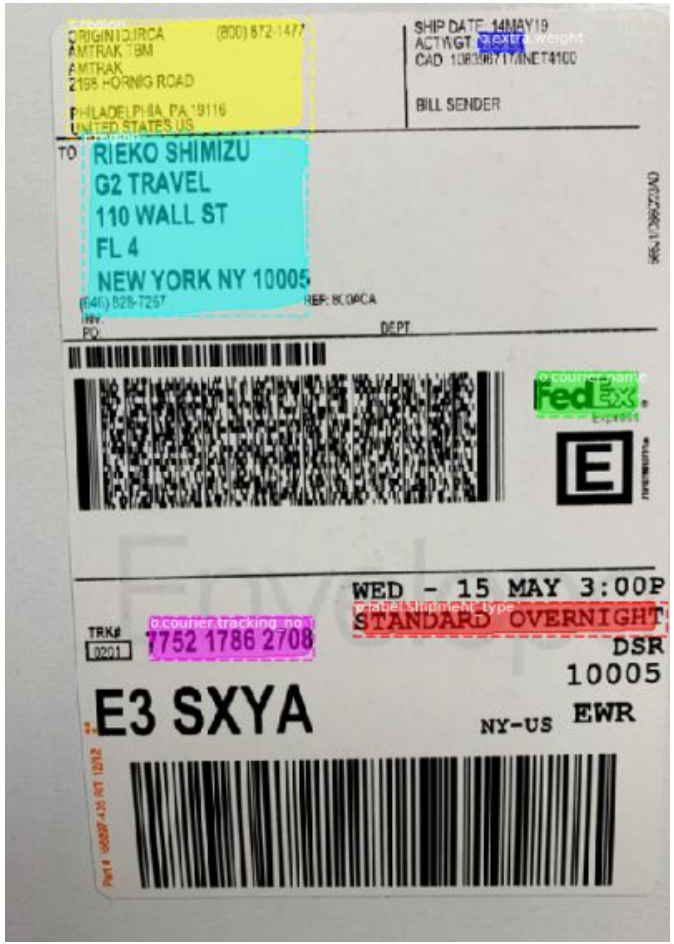
Region Localization

- Mask RCNN – Tensorflow Object Detection API

- Pretrained on COCO dataset

Region Localization

- Reduced Number of Entities
- Only apply NER on Sender and Receiver Regions



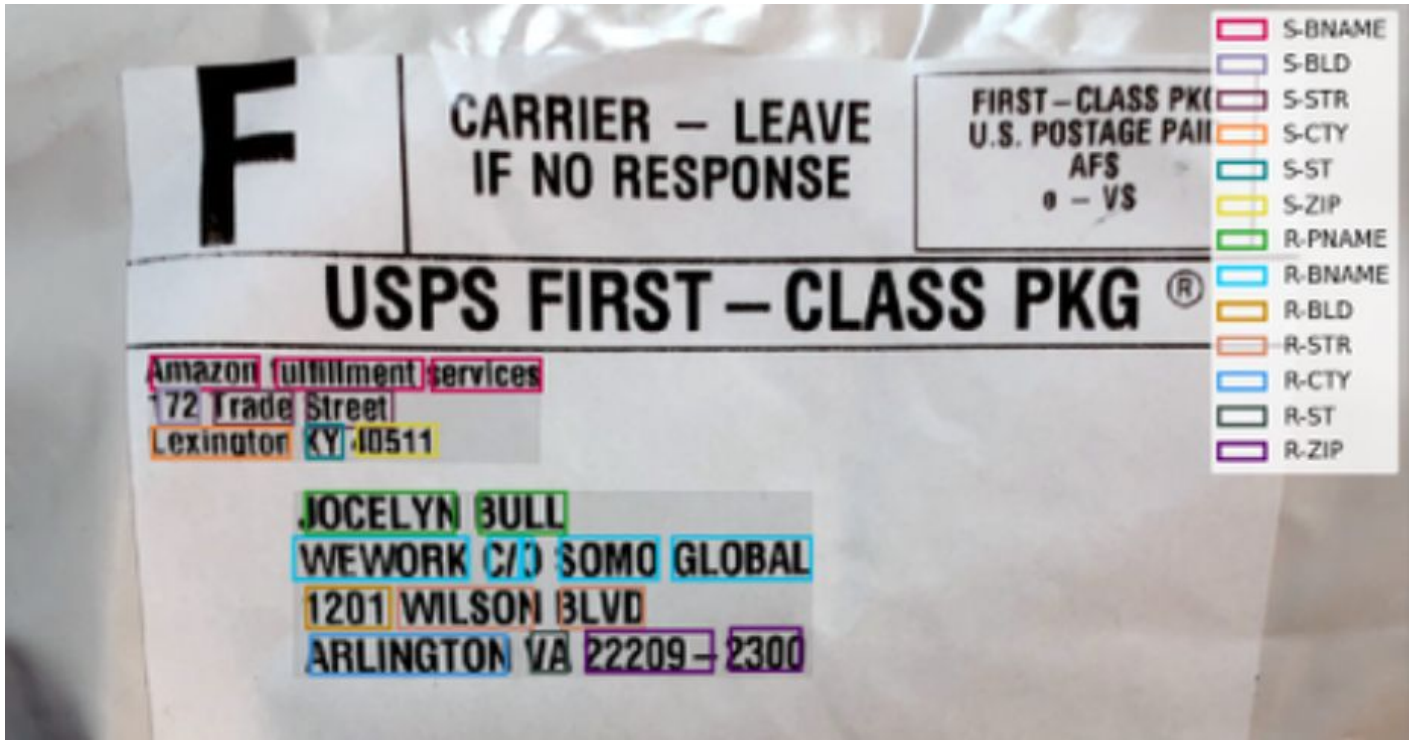
Two Step Approach

Model Evaluation

	precision	recall	f1-score	support
BLD	0.89	0.86	0.87	195
BNAME	0.75	0.77	0.76	363
CTRY	0.85	0.80	0.82	83
CTY	0.89	0.97	0.93	305
FLR	0.88	0.95	0.91	112
O	0.96	0.94	0.95	4302
ONUM	0.68	0.77	0.72	44
PNAME	0.80	0.83	0.82	197
ST	0.90	0.94	0.92	220
STR	0.92	0.93	0.92	372
TEL	0.87	0.91	0.89	93
ZIP	0.85	0.94	0.89	256
accuracy			0.93	6542
macro avg	0.85	0.88	0.87	6542
weighted avg	0.93	0.93	0.93	6542

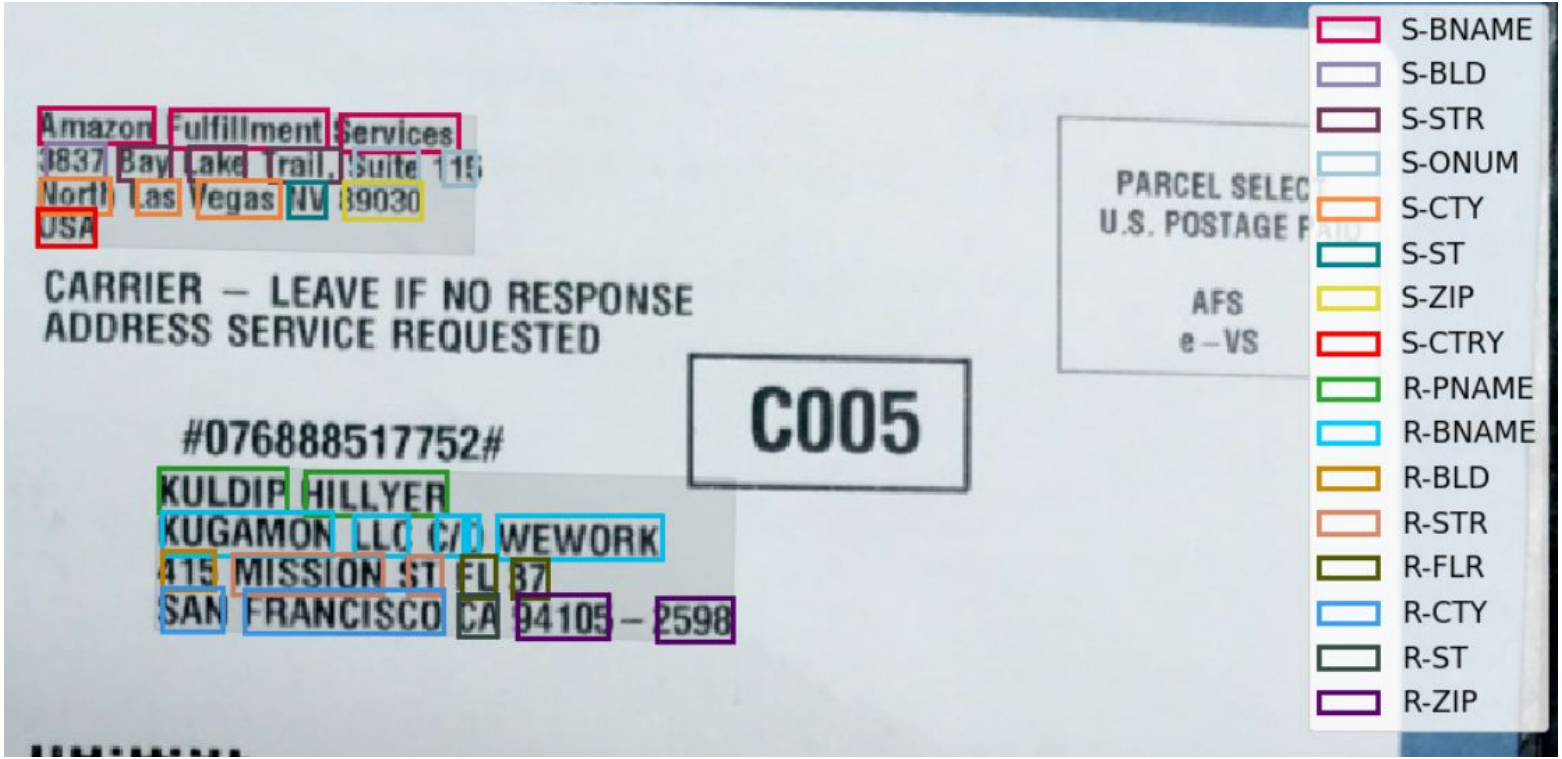
Two Step Approach

Model Prediction



Two Step Approach

Model Prediction



Thank You!