



Lights, Camera, Action!

A Framework to Improve NLP Accuracy over OCR documents

KDD – Document Intelligence
Workshop 2021



Collaborators

Amit Gupte
Program Manager
Microsoft - MAIDAP

Alexey Romanov
Data Scientist
Microsoft - MAIDAP

Sahitya Mantravadi
Data Scientist
Microsoft - MAIDAP

Jianjie Lui
Software Engineer
Microsoft - MAIDAP

Dalitso Banda
Software Engineer
Microsoft - MAIDAP

Raza Khan
Data Scientist
Azure AI

Lakshmanan Ramu Meenal
Software Engineer
Azure AI

Benjamin Han
Data Science Manager
Azure AI

Soundar Srinivasan
Director
Microsoft - MAIDAP

Introduction



- Document Digitization has become very easy.
- Optical Character Recognition allows us to extract text from documents and use NLP techniques these documents
- We are hence able to enable new experience like Search, Summarization and more on scanned documents.

Court behind it. It has voided laws creating Negro districts in cities, but upheld those compelling separate railroad accommodations, declaring that segregation is not discrimination when the facilities offered both races are substantially the same. Taking the same ground, the Interstate Commerce Commission recently dismissed a complaint filed by eighteen Negro seamen against the Atlantic Coast Line. The men asked for "a bold declaration that segregation in and of itself today must be regarded as constituting an unlawful discrimination." That puts the Negro attitude on segregation in a nutshell. The Commission responded, "What complainants asked us to decide is in its essence a social question and not a question of inequality of treatment."

This makes it lawful, if somewhat grotesque, for incidents like the following to happen. On a crowded troop train going through Texas the colored soldiers were fed behind a Jim Crow curtain at one end of the dining car. In the main section, along with the white folks, a group of German war prisoners dined—and no doubt fed their illusions of race superiority on that Jim Crow curtain.

The assignment of Negro units in the Army to menial jobs is a widespread practice. Colored inductees go to camp for military training and find themselves assigned to service units—cooking, shoveling coal, waiting on the white officers. Entering service, they may find themselves building the Burma Road, or African bases, or encountering winter temperatures of 30 degrees below zero hacking the Alaska Highway or the Canal pipeline out of the Canadian wastes. Meanwhile white units trained at the same time are in the fighting war, where the Negro longs to be. "The sight of masses of Negro soldiers constantly blocked off into separate groups and assigned to menial jobs," a white officer writes, "generates in the mind of the average soldier a powerful feeling of superiority and of being 'different!'"

A highly trained Negro technologist turned up in the psychotic ward of a hospital. His Army service was picking up papers around the officers' quarters in a Southern camp. When he was transferred to radio work his mental troubles vanished. Another inductee, a brilliant bio-chemist, had a fantastic Army career. At the reception center on the Pacific Coast the officers proposed to use his years of medical training to the Army's advantage. He was sent to Camp A for training and assigned to a post in the biological laboratory. Before he could start work he was shipped further east to Camp B, and enrolled for technical training as an aviator. He passed this course with high honors, and was promptly shipped to Camp C—farther west—classified as corporal and assigned to the Army Air Forces. A week later he found himself at Camp D in the Southwest, assigned to labor detail. That meant

losing his corporal's stripes gained in another division. He wrote his wife:

I find that this post is the "Port of Lost Hope." . . . Merciful God, I have not been so close to loss of faith as I am at this moment. . . . All this build-up for something to respect, only to be treated like a brainless gorilla fit for nothing more than a post-hole digger and a stringer of wire, a yard bird. . . . I swear if this was Guadalcanal or Australia or North Africa I would expect nothing and would give everything, even my life. . . . It is mockery, let no one tell you differently, this sudden opening up of the so-called exclusive branches of the services to Negroes. We are trained, become skilled—and then the oblivion of common labor.

It is no secret that the Air Corps wished no Negro inductees. But it was forced to let the color bar down late in 1940 and created ten "Aviation Squadrons (Separate)" which served no specific military need and were assigned to whatever odd jobs of common labor the various air fields could offer. There was no equivalent white organization and these Negro units would probably never have come into existence but for the necessity of making some provision for the Negroes enlisted in the Air Forces.

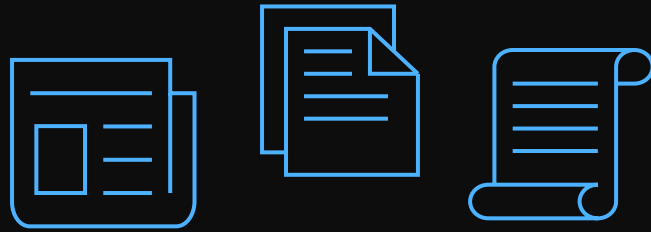
The Air Corps began by training Negroes for combat aviation in only one branch—pursuit flying. A segregated base was set up near Tuskegee Institute and advanced training was at Selfridge Field. Pursuit flying is the most difficult type of combat aviation. Perhaps the Air Corps was paying tribute to the Negro; possibly it was trying to discourage him. In any event, the pursuit flyers not only made good in training, but the Ninety-ninth Squadron, the first and only one sent abroad, has won special praise from Secretary of War Stimson and others for its fine spirit and the specialized dive bombing the men were called upon unexpectedly to perform when the squadron was on loan to the British Eighth Army in Italy.

In 1943, schools for bombardiers and navigators were opened to Negroes and the first squadron, known as Squadron 10, was graduated on February 26, 1944, at Hondo, Texas, and will now receive training as bombardiers.

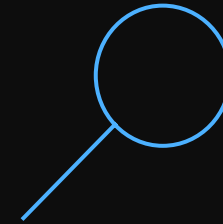
In some respects the Navy, with its ancient and Southern-gentleman traditions, tallies with the policy of the modern Air Command. Between 1922 and 1942 Negroes were "the chambermaids of the Navy," acting as stewards, chefs and messboys. Several months after Pearl Harbor the Navy broke down and admitted colored men as apprentice seamen with the chance of becoming petty officers. It has let down the bars to women—but no dark-skinned women. There are no colored Waves, Spars or Marine Corps Auxiliaries. And since no Negro could be commissioned up to a few weeks ago, there are no Negro chaplains in the Navy.

However, OCR on scanned Docs is far from ideal
This is due to the noise in those documents

The Problem



Analog Documents



Search Indices are Inaccurate

**Errors in OCR Process Hampers
Downstream NLP tasks**

**Text output from OCR is noisy that
results in incorrect input to NER Models**

**Cannot mine Information
From Documents Accurately**

**Users Create Search Indices in Cognitive Search Using Text Enrichments
Cannot find accurate information in their documents**

Our Goals



Create Noise Robust NER
Model

**Improve performance
on Noisy Data**

Using certain techniques, we try to make NER Models perform
Well even when OCR Output is noisy

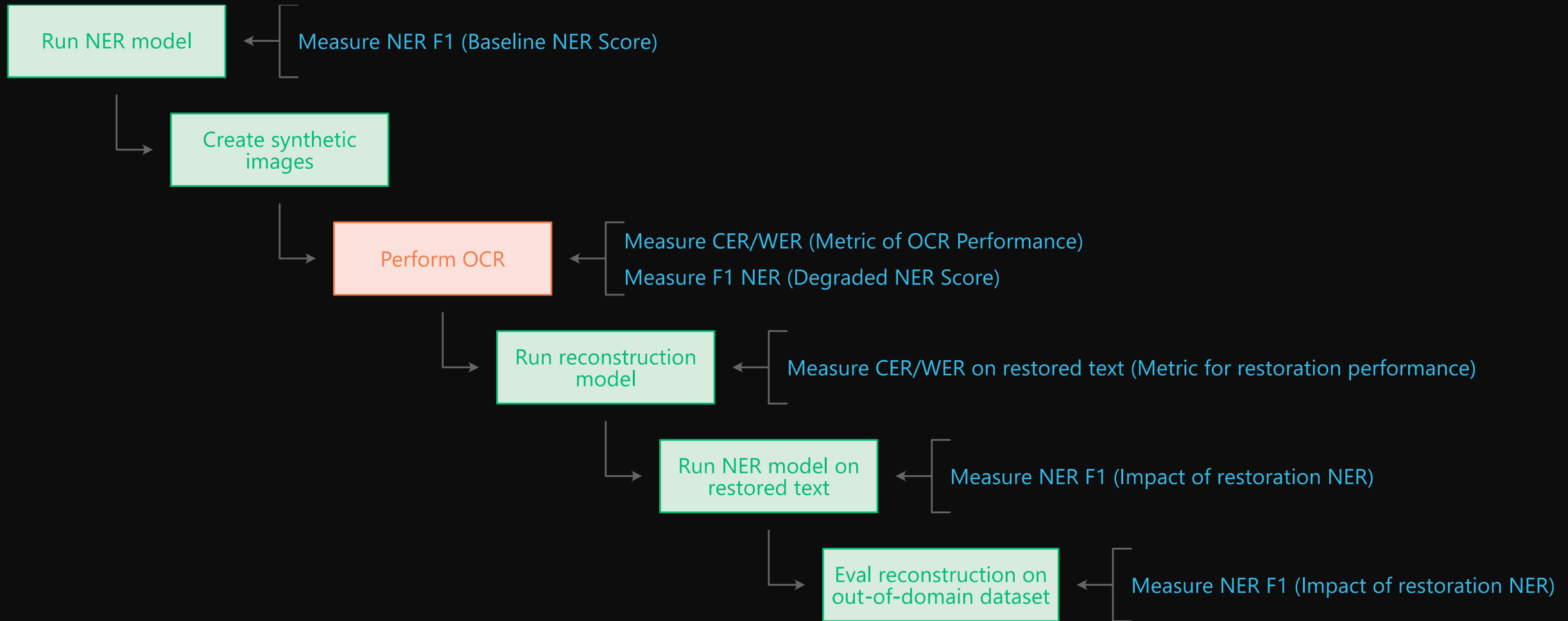


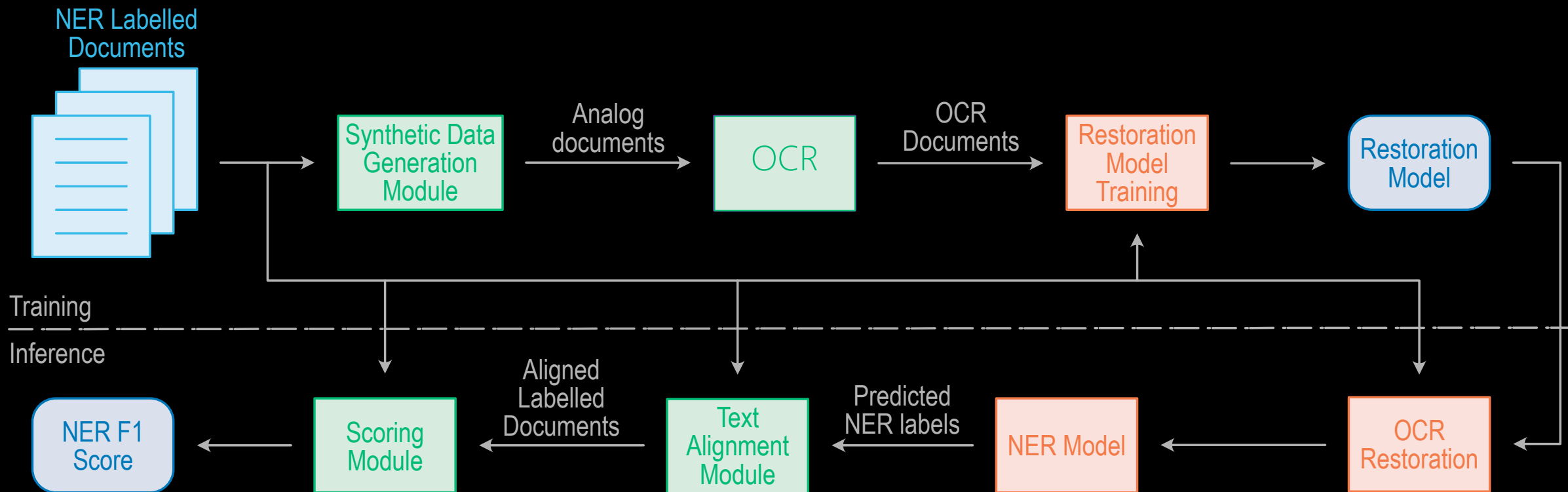
Generate Synthetic Data

Simulate OCR Noise

There is no Explicit NER Annotated OCR Data

Our Approach





Experimental setup

Genalog

- a platform-independent python package for generation of synthetic document images with custom degradations:
- Capabilities
 - Create **synthetic documents** in with HTML & CSS
 - Add **degradations** to simulate real world scans
 - Extract text from documents using **Azure OCR**
 - Efficient **text alignment** implementation for long document
- We are open-source on GitHub!
- Please visit our documentation: <https://microsoft.github.io/genalog/>



Genalog in Action

```
from genalog.pipeline import AnalogDocumentGeneration
from genalog.degradation.degrader import ImageState

sample_text = "sample/generation/example.txt"

# Common CSS properties
STYLE_COMBINATIONS = {
    "font_family" : ["sans-serif"], # sans-serif, Times, mono
    "font_size" : ["14px"],
    "text_align" : ["center"], # left, right, center, justify
    "language" : ["en-US"], # controls how words are hyphenated
    "hyphenate" : [True],
}

# <columns|letter|text_block>.html.jinja
HTML_TEMPLATE = "text_block.html.jinja"

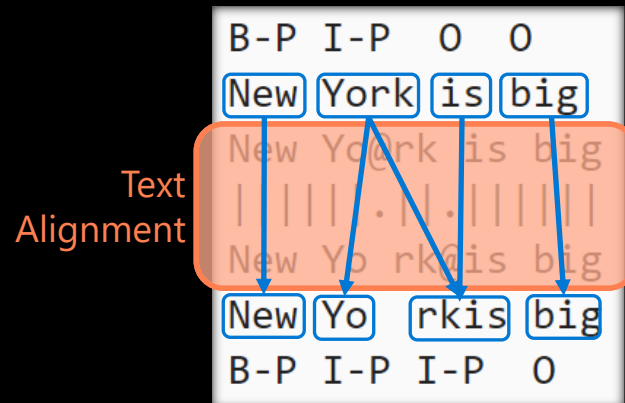
# Degradation effects applied in sequence
DEGRADATIONS = [
    # ("blur", {"radius": 3}), # needs to be an odd number
    # ("bleed_through", {
    #     "src": ImageState.CURRENT_STATE, "background": ImageState.CURRENT_STATE,
    #     "alpha": 0.8,
    #     "offset_y": 9,
    # }),
    # ("morphology", {"operation": "open", "kernel_shape":(9,9)}),
    # ("pepper", {"amount": 0.01}),
    # ("salt", {"amount": 0.2}),
]
```

Time magazine, in a move to reduce the costs of wooing new subscribers, is lowering its circulation guarantee to advertisers for the second consecutive year, increasing its subscription rates and cutting back on merchandise giveaways. In an announcement to its staff last week, executives at Time Warner Inc. 's weekly magazine said Time will ``dramatically de-emphasize `` its use of electronic giveaways such as telephones in television subscription drives; cut the circulation it guarantees advertisers by 300,000, to four million; and increase the cost of its annual subscription rate by about \$ 4 to \$ 55. In a related development, the news - weekly, for the fourth year in a row, said it wo n't increase its advertising rates in 1990; a full, four - color page in the magazine costs about \$ 120,000. However, because the guaranteed circulation base is being lowered, ad rates will be effectively 7.5 % higher per subscriber, according to Richard Heinemann, Time associate publisher. Time is following the course of some other mass - circulation magazines that in recent years have challenged the publishing myth that maintaining artificially high, and expensive, circulations is the way to draw advertisers. In recent years, Reader 's Digest, New York Times Co. 's McCall 's, and most recently News Corp. 's TV Guide, have cut their massive circulation rate bases to eliminate marginal circulation and hold down rates for advertisers. Deep discounts in subscriptions and offers of free clock radios and watches have become accepted forms of attracting new subscribers in the hyper-competitive world of magazine news - weeklies. But Time, as part of the more cost - conscious Time Warner, wants to wean itself away from expensive gimmicks. Besides, Time executives think selling a news magazine with a clock radio is tacky. `` Giveaways just give people the wrong image, " said Mr. Heinemann. `` That perception takes the focus off the magazine. " Time magazine executives predictably paint the circulation cut as a show of strength and actually a benefit to advertisers. `` What we are doing is screening out the readers who are only casually related to the magazine and do n't really read it, " said Mr. Heinemann. `` We are trying to create quality and involvement. " However, Time executives used the same explanation when in October 1988 the magazine cut its guaranteed circulation from 4.6 million to 4.3 million. And Time 's paid circulation, according to Audit Bureau of Circulations, dropped 7.3 % to 4,393,237 in the six months ended June 30, 1989. Still, Time 's move is being received well, once again. `` It 's terrific for advertisers to know the reader will be paying more, " said Michael Drexler, national media director at Bozell Inc. ad agency. `` A few drops in circulation are of no consequence. It 's not a show of weakness; they are improving the quality of circulation while insuring their profits. " Mr. Heinemann said the changes represent a new focus in the magazine industry: a magazine 's net revenue per subscriber, or the actual revenue from subscribers after discounts and the cost of premiums have been stripped away. `` The question is how much are we getting from each reader, " said Mr. Heinemann. Time 's rivals news - weeklies, Washington Post Co. 's Newsweek and U.S. News & World Report, are less reliant on electronic giveaways, and in recent years both have been increasing their circulation rate bases. Both magazines are expected to announce their ad rates and circulation levels for 1990 within a month.

Handling Noisy Text

Now, imagine we have obtained a noisy version of the ground truth text through the OCR process, for example. The problem becomes: how can we label the noisy tokens?

```
NER Labels: B-P I-P O O
GT Text: New York is big
Noisy Text: New Yo rkis big
NER Labels: ? ? ? ?
```



Genalog provides efficient text alignment algorithm for longer text based on the [RETAS method](#) that is **100x*** faster than traditional alignment algorithms

Please see Genalog's documentation on: [Text Alignment](#) & [Label Propagation](#)

* This number is sourced from the paper : [A Fast Alignment Scheme for Automatic OCR Evaluation of Books](#). And we found similar results in our experiments.

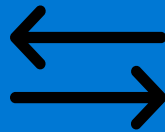
Enki Model Development

Common approaches to text restoration



Seq2Seq

- Suffers with long sequences



Bi-LSTM prediction

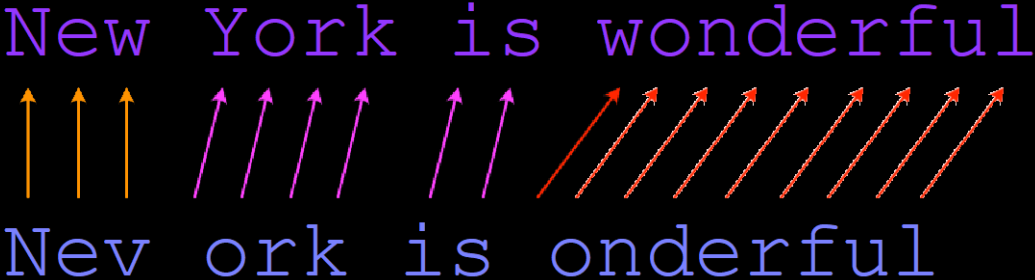
- Character shift problem



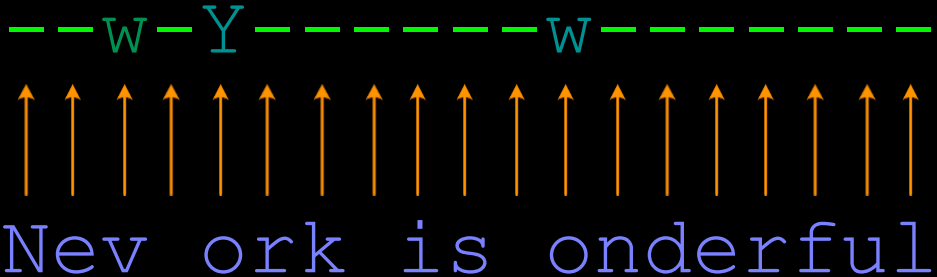
Action prediction

- Our approach

Character shift problem

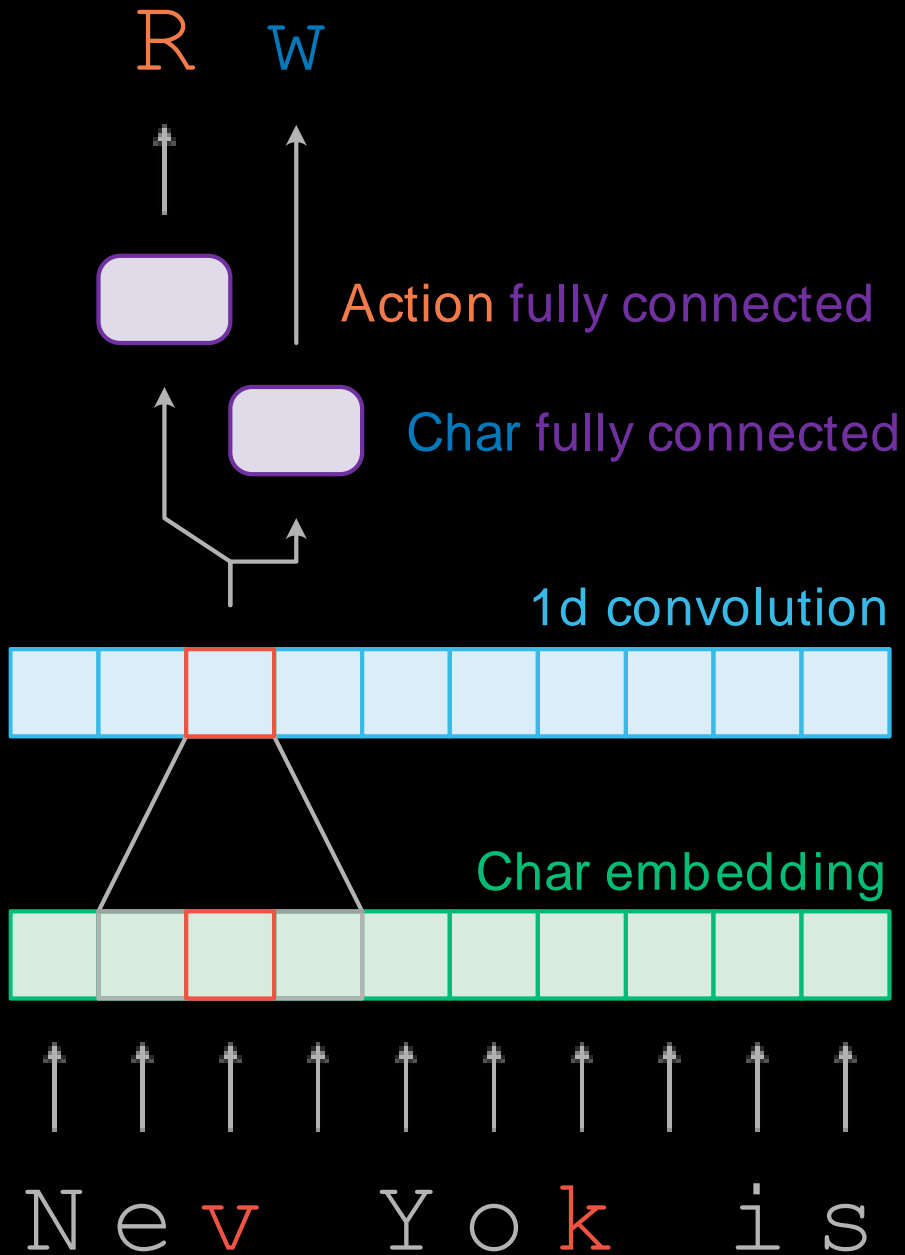


Bi-LSTM suffers from a cumulative character shift



Action prediction does not have this problem

Model Architecture



- Approach:
 - Reconstruct text to remove OCR errors
 - Run NER on reconstructed text
- Action Prediction Restoration model:
 - For each character in the input sequence, use surrounding context to classify whether:
 - INSERT
 - INSERT_SPACE
 - DELETE
 - REPLACE
 - NO ACTION
 - Perform that action with the correct character

Restoration Results

OCR Sentence

No one will be able to **rec- ognize** her body !
Although **!** still have n't made the final decision to go
Why do you think the North Koreans chose **july Fourth** /?
israel says **&** may abandon the peace negotiations altogether .
! will protect this **cky** and save it .

Reconstructed Sentence

No one will be able to **recognize** her body .
Although **I** still have n't made the final decision to go
Why do you think the North Koreans chose **July Fourth** /?
Israel says **it** may abandon the peace negotiations altogether .
I will protect this **city** and save it .

Performance of Action Prediction Model

Dataset	Degradation Type	OCR Accuracy		Reconstruction Accuracy	
		Char	Word	Char	Word
CoNLL 2012	All Degradation Light	0.986	0.927	0.991	0.962
CoNLL 2003	All Degradation Light	0.989	0.942	0.994	0.969
CoNLL 2012	All Degradation Heavy	0.900	0.661	0.907	0.732
CoNLL 2003	All Degradation Heavy	0.900	0.646	0.903	0.700

Performance of NER – CoNLL 2012/2003/CNN

Dataset	Degradation Type	NER on Clean Text	NER on Degraded Text	NER on Restored Text	Relative Gap Reduction
CoNLL 2012	All Degradation Light	0.832	0.783	0.819	73%
CoNLL 2003	All Degradation Light	0.860	0.820	0.841	52%
CNN Daily Mail	All Degradation Light	0.989	0.590	0.895	76%

Conclusions & Learnings

- GenaLog is able to generate **synthetic images** with realistic **degradations**
- **Action prediction** model successfully mitigates the **character shift problem**
- Trained on the **synthetic data**, the action prediction model is able to **restore the text from OCR errors**
- The restoration **significantly reduces** the drop in the accuracy from OCR errors on the **downstream NER task**

Thanks!



Checkout Genalog and give it a like 



Give our Paper a read



Connect with us 😊

Document Generation Results

Some Research Paper: This is a Synthetic Document

Author A, Author B, Author C,
Some Organization ABC,
One Organization Road
Town A, State, 0001
someone@gmail.com

Section 0:

This is Shi'nao Mountain, situated in Yangquan, Shanxi, a strategic passage of the Zhengtai Railway back then. On August 21, 1940, in order to pin down Japanese troops stationed in Yangquan and to cover for militiamen sabotaging the western section of the Zhengtai Railway, the 129th Division of the Eighth Route Army ordered the main regiment of its 385th Brigade, the 14th Regiment led by Brigade Commander Chen Xilian, to head directly for Shi'nao Mountain to seize the high ground. Like a sharp sword, civilians in the western section broke through the strategic passage. Frustrated and angry, the Japanese army immediately deployed a large number of troops in an attempt to retake Shi'nao Mountain. To the enemy's complete surprise, desolate Shi'nao Mountain had been turned into a strong combat fortress by our troops in less than a night. Like a lion with its mouth wide open, towering and rugged Shi'nao Mountain was constantly waiting for any invaders who dared come close.

The night before, we destroyed the roads and cut off all electrical and railway lines, making it impossible for it to communicate. It did not know how many of us went to destroy the roads, whether it was the Eighth Route Army or not, the regulars, or others. I did not know, right? After all, its telephones had stopped working. Yeah, the roads had been cut off, with its vehicles unable to drive back and forth. The following seven days and nights were extremely tough. Starting from the 23rd, the Japanese army in Yangquan, backed by helicopters, launched nonstop fierce attacks on Shi'nao Mountain using chemical weapons. During the Shi'nao Mountain battle, our soldiers died in large numbers. So many died that the clean-up was done in batches. In addition, many people were poisoned when toxic gas was released.

They were poisoned and did not know how to protect themselves against the poison. They simply crawled on the ground and wetted handkerchiefs in the rain to cover their noses against the poison. Eh, medics were quite busy. Several days of autumn rain turned the combat trenches extremely muddy. The Eighth Route Army officers and soldiers soaking in the muddy water fought their powerful enemy with utmost effort. With bombs exploding next to the trenches, they showed no fear at all. When their blood turned the yellow soil red, they applied iodine solution to their wounds and closed them with bandages. They wrapped them with bandages, and that was it. Under the powerful

offensive of the Eighth Route Army, the enemy was only able to defend itself, without any strength to fight back. The battle proceeded very smoothly, with the initiative steadily in the grasp of the Eighth Route Army.

Section 1:

Since the strategic objective of the Hundred Regiments Offensive was to smash the enemy's blockade of bases, it was of critical importance to destroy the roads and remove strongholds. The various units of the Eighth Route Army taking part in the battle wasted no time destroying the roads. They proposed not to leave behind a single rail, a single cross tie, a single railway station, a single blockhouse, a single bridge, or a single electricity pole. They mobilized and organized the masses and won over the railway staff, making great effort to destroy the railroad, the stations, and related facilities by means including dismantlement, explosion, fire, and water. I was in charge of this, er, and - Er, er, due to this - To cut off the electricity, er, considered a deputy commander-in-chief responsible for these electricity lines. I was responsible for this project, ah. The militiamen were divided into two groups. One was responsible only for cutting electrical wires and the other for destroying roads. We people, ah, were under his command for the time being. We all took part in destroying roads. From the Zhengtai road, from um, Zhengding to um, Shijiazhuang, to Taiyuan, more than 400,000 civilians participated in destroying roads. Most important at that time along the Zhengtai road was mainly to destroy the Jinai coal mine. Soldiers used hay cutters to sever the wire net, charging into the station and destroying the machine room and water tower, and then started to destroy the road. Of the three to four thousand civilians participating in the battle, one soldier was added to every squad of 16 people formed. While destroying roads, there was clear-cut division of labor. Some took off screws; some uprooted rail spikes; some knocked off joint bars; some removed cross ties; some carried away rails. For cutting electrical wires, the militiamen in the villages were waiting for the troops to come. Ah, Over there, a builder of the surrounding walls sabotaged transportation by pushing over his surrounding walls. It was built during the day, and at night, overnight militiamen shoveled it over. The task of the 72nd Regiment was, er, this destruction battle. This destruction battle went on for a day and a night. Each day the general situation was different. -LSB- -LSB-

Some Research Paper: This is a Synthetic Document

Author A, Author B, Author C,
Some Organization ABC,
One Organization Road
Town A, State, 0001
someone@gmail.com

Section 0:

This is Shi'nao Mountain, situated in Yangquan, Shanxi, a strategic passage of the Zhengtai Railway back then. On August 21, 1940, in order to pin down Japanese troops stationed in Yangquan and to cover for militiamen sabotaging the western section of the Zhengtai Railway, the 129th Division of the Eighth Route Army ordered the main regiment of its 385th Brigade, the 14th Regiment led by Brigade Commander Chen Xilian, to head directly for Shi'nao Mountain to seize the high ground. Like a sharp sword, civilians in the western section broke through the strategic passage. Frustrated and angry, the Japanese army immediately deployed a large number of troops in an attempt to retake Shi'nao Mountain. To the enemy's complete surprise, desolate Shi'nao Mountain had been turned into a strong combat fortress by our troops in less than a night. Like a lion with its mouth wide open, towering and rugged Shi'nao Mountain was constantly waiting for any invaders who dared come close.

The night before, we destroyed the roads and cut off all electrical and railway lines, making it impossible for it to communicate. It did not know how many of us went to destroy the roads, whether it was the Eighth Route Army or not, the regulars, or others. I did not know, right? After all, its telephones had stopped working. Yeah, the roads had been cut off, with its vehicles unable to drive back and forth. The following seven days and nights were extremely tough. Starting from the 23rd, the Japanese army in Yangquan, backed by helicopters, launched nonstop fierce attacks on Shi'nao Mountain using chemical weapons. During the Shi'nao Mountain battle, our soldiers died in large numbers. So many died that the clean-up was done in batches. In addition, many people were poisoned when toxic gas was released.

They were poisoned and did not know how to protect themselves against the poison. They simply crawled on the ground and wetted handkerchiefs in the rain to cover their noses against the poison. Eh, medics were quite busy. Several days of autumn rain turned the combat trenches extremely muddy. The Eighth Route Army officers and soldiers soaking in the muddy water fought their powerful enemy with utmost effort. With bombs exploding next to the trenches, they showed no fear at all. When their blood turned the yellow soil red, they applied iodine solution to their wounds and closed them with bandages. They wrapped them with bandages, and that was it. Under the powerful

offensive of the Eighth Route Army, the enemy was only able to defend itself, without any strength to fight back. The battle proceeded very smoothly, with the initiative steadily in the grasp of the Eighth Route Army.

Section 1:

Since the strategic objective of the Hundred Regiments Offensive was to smash the enemy's blockade of bases, it was of critical importance to destroy the roads and remove strongholds. The various units of the Eighth Route Army taking part in the battle wasted no time destroying the roads. They proposed not to leave behind a single rail, a single cross tie, a single railway station, a single blockhouse, a single bridge, or a single electricity pole. They mobilized and organized the masses and won over the railway staff, making great effort to destroy the railroad, the stations, and related facilities by means including dismantlement, explosion, fire, and water. I was in charge of this, er, and - Er, er, due to this - To cut off the electricity, er, considered a deputy commander-in-chief responsible for these electricity lines. I was responsible for this project, ah. The militiamen were divided into two groups. One was responsible only for cutting electrical wires and the other for destroying roads. We people, ah, were under his command for the time being. We all took part in destroying roads. From the Zhengtai road, from um, Zhengding to um, Shijiazhuang, to Taiyuan, more than 400,000 civilians participated in destroying roads. Most important at that time along the Zhengtai road was mainly to destroy the Jinai coal mine. Soldiers used hay cutters to sever the wire net, charging into the station and destroying the machine room and water tower, and then started to destroy the road. Of the three to four thousand civilians participating in the battle, one soldier was added to every squad of 16 people formed. While destroying roads, there was clear-cut division of labor. Some took off screws; some uprooted rail spikes; some knocked off joint bars; some removed cross ties; some carried away rails. For cutting electrical wires, the militiamen in the villages were waiting for the troops to come. Ah, Over there, a builder of the surrounding walls sabotaged transportation by pushing over his surrounding walls. It was built during the day, and at night, overnight militiamen shoveled it over. The task of the 72nd Regiment was, er, this destruction battle. This destruction battle went on for a day and a night. Each day the general situation was different. -LSB- -LSB-



Company X
One Company Road
City, State, 0001
January 1st, 2020

Dear Mr/Ms. X,

This is Shi'nao Mountain, situated in Yangquan, Shanxi, a strategic passage of the Zhengtai Railway back then. On August 21, 1940, in order to pin down Japanese troops stationed in Yangquan and to cover for militiamen sabotaging the western section of the Zhengtai Railway, the 129th Division of the Eighth Route Army ordered the main regiment of its 385th Brigade, the 14th Regiment led by Brigade Commander Chen Xilian, to head directly for Shi'nao Mountain to seize the high ground. Like a sharp sword, civilians in the western section broke through the strategic passage. Frustrated and angry, the Japanese army immediately deployed a large number of troops in an attempt to retake Shi'nao Mountain. To the enemy's complete surprise, desolate Shi'nao Mountain had been turned into a strong combat fortress by our troops in less than a night. Like a lion with its mouth wide open, towering and rugged Shi'nao Mountain was constantly waiting for any invaders who dared come close.

The night before, we destroyed the roads and cut off all electrical and railway lines, making it impossible for it to communicate. It did not know how many of us went to destroy the roads, whether it was the Eighth Route Army or not, the regulars, or others. I did not know, right? After all, its telephones had stopped working. Yeah, the roads had been cut off, with its vehicles unable to drive back and forth. The following seven days and nights were extremely tough. Starting from the 23rd, the Japanese army in Yangquan, backed by helicopters, launched nonstop fierce attacks on Shi'nao Mountain using chemical weapons. During the Shi'nao Mountain battle, our soldiers died in large numbers. So many died that the clean-up was done in batches. In addition, many people were poisoned when toxic gas was released.

This is Shi'nao Mountain &, situated in Yangquan, Shanxi, a strategic passage of the Zhengtai Railway back then. On August 21, 1940, in order to pin down Japanese troops stationed in Yangquan and to cover for militiamen sabotaging the western section of the Zhengtai Railway, the 129th Division of the Eighth Route Army ordered the main regiment of its 385th Brigade, the 14th Regiment led by Brigade Commander Chen Xilian, to head directly for Shi'nao Mountain to seize the high ground. Like a sharp sword, civilians in the western section broke through the strategic passage. Frustrated and angry, the Japanese army immediately deployed a large number of troops in an attempt to retake Shi'nao Mountain. To the enemy's complete surprise, desolate Shi'nao Mountain had been turned into a strong combat fortress by our troops in less than a night. Like a lion with its mouth wide open, towering and rugged Shi'nao Mountain was constantly waiting for any invaders who dared come close. The night before, we destroyed the roads and cut off all electrical and railway lines, making it impossible for it to communicate. It did not know how many of us went to destroy the roads, whether it was the Eighth Route Army or not, the regulars, or others. I did not know, right? After all, its telephones had stopped working. Yeah, the roads had been cut out, with its vehicles unable to drive back and forth. The following seven days and nights were extremely tough. Starting from the 23rd, the Japanese army in Yangquan, backed by helicopters, launched nonstop fierce attacks on Shi'nao Mountain using chemical weapons. During the Shi'nao Mountain battle, our soldiers died in large numbers. So many died that the clean-up was done in batches. In addition, many people were poisoned when toxic gas was released. They were poisoned and did not know how to protect themselves against the poison. They simply crawled on the ground and wetted handkerchiefs in the rain to cover their noses against the poison. Eh, medics were quite busy. Several days of autumn rain turned the combat trenches extremely muddy. The Eighth Route Army officers and soldiers soaking in the muddy water fought their powerful enemy with utmost effort. With bombs exploding next to the trenches, they showed no fear at all. When their blood turned the yellow soil red, they applied iodine solution to their wounds and closed them with bandages. They wrapped them with bandages, and that was it. Under the powerful offensive of the Eighth Route Army, the enemy was only able to defend itself, without any strength to fight back. The battle proceeded very smoothly, with the initiative steadily in the grasp of the Eighth Route Army.

Two column Scientific Paper

Two column Scientific Paper
with Plots

Letter Style

Block Text

Image Degradation Examples

Time magazine , in a move to reduce the guaranteed circulation base, has agreed to a new guarantee to advertisers for the second year. The magazine will back on merchandise giveaways . In 1990, Time Inc. 's weekly magazine said Time magazine's circulation was such as telephones in television subscriptions, 300,000 , to four million ; and increased by a related development , the news - week advertising rates in 1990 ; a full , four - million subscriber , according to Richard Healy, publisher of some other mass - circulation magazine.

No Degradations

Time magazine , in a move to reduce the guaranteed circulation base, has agreed to a new guarantee to advertisers for the second year. The magazine will back on merchandise giveaways . In 1990, Time Inc. 's weekly magazine said Time magazine's circulation was such as telephones in television subscriptions, 300,000 , to four million ; and increased by a related development , the news - week advertising rates in 1990 ; a full , four - million subscriber , according to Richard Healy, publisher of some other mass - circulation magazine.

All Degradations

Time magazine , in a move to reduce the guaranteed circulation base, has agreed to a new guarantee to advertisers for the second year. The magazine will back on merchandise giveaways . In 1990, Time Inc. 's weekly magazine said Time magazine's circulation was such as telephones in television subscriptions, 300,000 , to four million ; and increased by a related development , the news - week advertising rates in 1990 ; a full , four - million subscriber , according to Richard Healy, publisher of some other mass - circulation magazine.

Salt

Time magazine , in a move to reduce the guaranteed circulation base, has agreed to a new guarantee to advertisers for the second year. The magazine will back on merchandise giveaways . In 1990, Time Inc. 's weekly magazine said Time magazine's circulation was such as telephones in television subscriptions, 300,000 , to four million ; and increased by a related development , the news - week advertising rates in 1990 ; a full , four - million subscriber , according to Richard Healy, publisher of some other mass - circulation magazine.

Bleed-through

Time magazine , in a move to reduce the guaranteed circulation base, has agreed to a new guarantee to advertisers for the second year. The magazine will back on merchandise giveaways . In 1990, Time Inc. 's weekly magazine said Time magazine's circulation was such as telephones in television subscriptions, 300,000 , to four million ; and increased by a related development , the news - week advertising rates in 1990 ; a full , four - million subscriber , according to Richard Healy, publisher of some other mass - circulation magazine.

Pepper

Time magazine , in a move to reduce the guaranteed circulation base, has agreed to a new guarantee to advertisers for the second year. The magazine will back on merchandise giveaways . In 1990, Time Inc. 's weekly magazine said Time magazine's circulation was such as telephones in television subscriptions, 300,000 , to four million ; and increased by a related development , the news - week advertising rates in 1990 ; a full , four - million subscriber , according to Richard Healy, publisher of some other mass - circulation magazine.

Blur

Time magazine , in a move to reduce the guaranteed circulation base, has agreed to a new guarantee to advertisers for the second year. The magazine will back on merchandise giveaways . In 1990, Time Inc. 's weekly magazine said Time magazine's circulation was such as telephones in television subscriptions, 300,000 , to four million ; and increased by a related development , the news - week advertising rates in 1990 ; a full , four - million subscriber , according to Richard Healy, publisher of some other mass - circulation magazine.

Open