

University Of Karachi
Department Of Computer Science

DOCUMENT LAYOUT ANALYSIS

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Contents

- Problem Statement
- Why It is important to Solve the Chosen Problem?
- Data Acquisition (Input Images)
- Block Diagram
- GUI
- intermediate and output images (Important Results)
- Preprocessing Details
- Algorithm Description
 - Image Segmentation
 - Feature Extraction
 - Matching Criteria
- Challenges/ Difficulties
- Learning and Achievements
- Improvements and Future Work
- Demo and Queries

Problem Statement

- The process of document structure and layout analysis tries to decompose a given document image into its component regions and understand their functional roles and relationships.
- The process of Document Layout Analysis aims to decompose a document image into a hierarchy of homogenous regions, such as figures, background, text blocks, text lines, words, characters, etc.
- We assign functional or logical labels to some of these regions.

Importance

To Solve the given Problem is important because automatic analysis of an arbitrary document with complex layout is an extremely difficult task and is beyond the capabilities of layout analysis systems these days. This is interesting since documents are designed to be effective and clear to human interpretation.

Data Acquisition

IN THIS SECTION WE DESCRIBE THAT HOW WE ACQUIRE INPUT IMAGES / VIDEO FOR PROCESSING. INPUT IMAGES ARE ALSO SHOWN TO UNDERSTAND THE ADDRESSED PROBLEM.

Newspaper images are a good way to start document structure analysis. We gathered the images from **epaper.dawn.com**.

India finds no role of Pakistan govt in Pathankot attack

By Our Correspondent

NEW DELHI: There is no evidence so far to indicate direct complicity of Pakistan government or its agencies in the Pathankot attack, India's probe chief has said.

"No evidence to show that Pakistan government or Pakistani government agency was helping Jaish-e-Mohammad or Masood Azhar or his aides carry out the Pathankot attack," Director General of the National Investigation Agency (NIA) Sharad Kumar said in a TV interview broadcast on Thursday.

Mr Kumar's remarks coincided with preparations for Prime Minister Narendra Modi's visit to Washington next week, which has been urging

improved relations between India and Pakistan. Moreover, Indian officials were sharing their findings with the FBI, which could perhaps be a factor in Mr Kumar's professional comments bereft of finger pointing at Pakistan.

Reports surfaced in April that to bolster its case against the Jaish-e-Mohammad and its chief Maulana Masood Azhar over the Pathankot terror attack, the NIA had approached several foreign investigating agencies, including the FBI, for assistance. The NIA wanted the FBI's help in mapping cyber footprints of Azhar's brother, Abdul Rauf. It also got in touch with agencies of a few other countries to map the financial trail in the terror attack case.

The NIA's reputation at home remains mired in controversy, how-

ever, fuelling fears that it was pliable to political pressure. It was responsible for investigating major attacks by alleged Hindutva terror groups in Malegaon and Samjhauta Express among other outrages.

However, reports have quoted the agency as claiming that the slain anti-terror police chief Hemant Karkare planted evidence implicating some Hindutva sympathisers. Karkare was mysteriously killed in the terror chaos by a sniper, who the government says was one of the terrorists from Pakistan.

Mr Kumar told News18 TV channel that his agency had completed its India leg of investigation and was waiting for Pakistan to allow its team to visit there to complete the investigations. "We are hopeful," he said when asked if Pakistan

would allow NIA to visit on the basis of reciprocity.

He was sure, however, that the charge-sheet in the terror case would be filed even if Pakistan did not give NIA access. "We have sufficient and stringent evidence against Maulana Masood Azhar and his brother Rauf Azhar and we will include those in our charge-sheet," he said.

When asked if he had found any evidence that Pakistani government agencies were aiding the terrorists to enter India and attack Pathankot, he said: "No. So far no evidence to show that Pakistan government or Pakistani government agency was helping Jaish or Masood Azhar or his aides carry out Pathankot attack."

In reply to a question, Mr Kumar said

so far his probe did not point to any inside help to terrorists in Pathankot. "If there were security lapses it was the government's concern. We are an investigating agency. We are investigating the case as a crime. We will not recommend any action for lapses or security breach."

Mr Kumar refused to comment on the role of Salwinder Singh, the Punjab Police SP, as accused or witness.

"At the time of filing charge-sheet we shall reveal what his status is. But at this point I don't want to give him a clean chit," he said.

The NIA probe had not found any narcotics angle to Salwinder Singh. "We searched his house. Sent sniffer dogs, but did not find any evidence to support these claims."

Waterfalls add to beauty of Shangla, Kohistan tourist sites

By Umar Bacha

SHANGLA: The northern areas of Pakistan are famous for their beautiful waterfalls, mostly located in Kohistan and Shangla districts.

About 100 waterfalls are located in Bisham, Shangla and upper Kohistan districts and most of them could be seen stretching along Indus River while travelling through the Karakoram Highway.

The large and charming waterfalls originating at 1,000 to 5,000 meters height and falling with a great speed attract large crowds. These are regarded as tourist spots and a large number of domestic and foreign tourists visit them. The tourists also enjoy seeing scenic waterfalls wherever they travel in Gilgit-Baltistan and Hunza.

"The waterfall is really amazing to see besides enjoying cool winds and humming sounds," said Aksa Nauman, a member of a tourist family making snaps with a waterfall at Dassu.

She said that from Bisham to Chilas they had seen many beautiful waterfalls from their vehicle. She said that the Indus River flowing along Karakoram Highway also presents another scenic view.

Ashfaq Ahmed, a tourist from Lahore, said that he had only seen such beautiful water-

falls in movies, but today he enjoyed the panoramic view of the waterfall from atop and its roaring noise punctuated by chirping of birds.

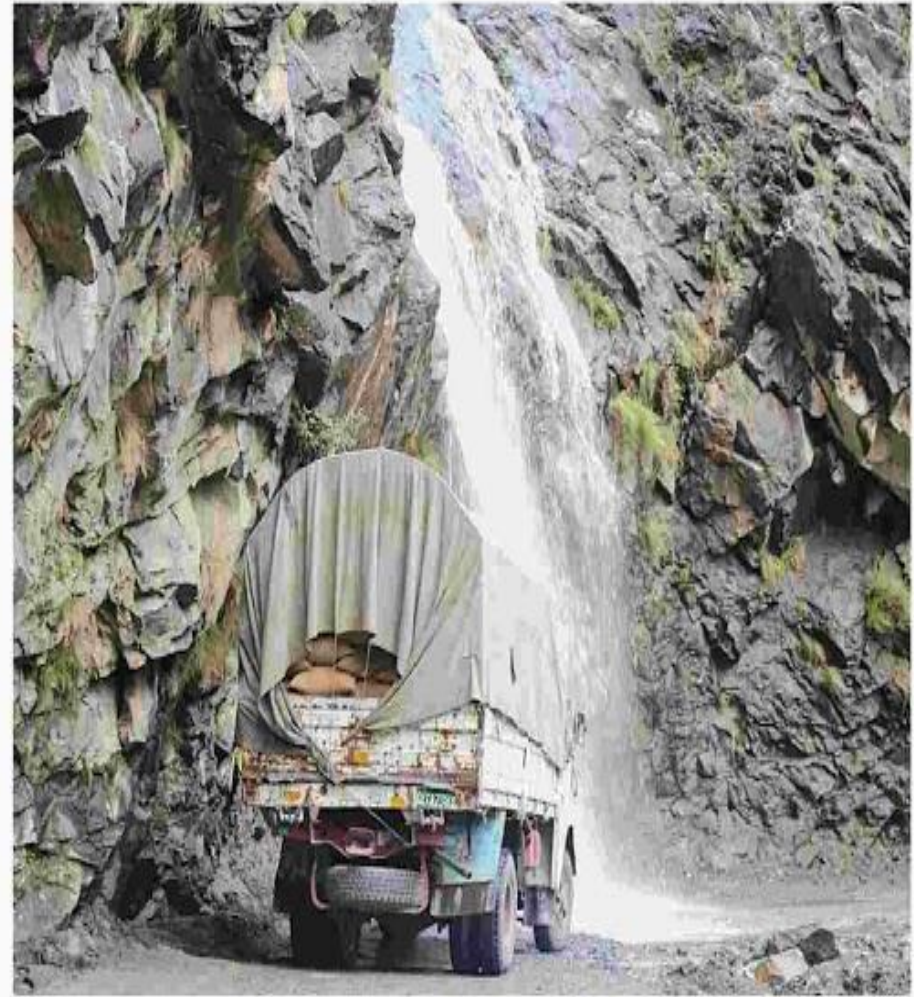
"The government could generate big revenue by developing these waterfalls into proper tourist spots in Shangla and Kohistan districts. There are no such facilities for tourists like hotels here," he said.

A foreign tourist, Adeen Kalam, told this correspondent that he enjoyed seeing natural scenery and the queue of waterfalls along the Karakoram Highway and Indus River besides the lush green mountains. However, he complained that the road from Dassu to Chilas was in a dilapidated condition and created difficulties for tourists.

"The government should take steps for providing facilities to tourists along the Karakoram Highway and ensure installing signboards to guide them about the tourist spots in Kohistan," he said.

When contacted, MPA Abdul Sattar Khan said that Kohistan was full of natural beauty; there are numerous waterfalls, springs, rare birds and many picturesque scenes in the valley.

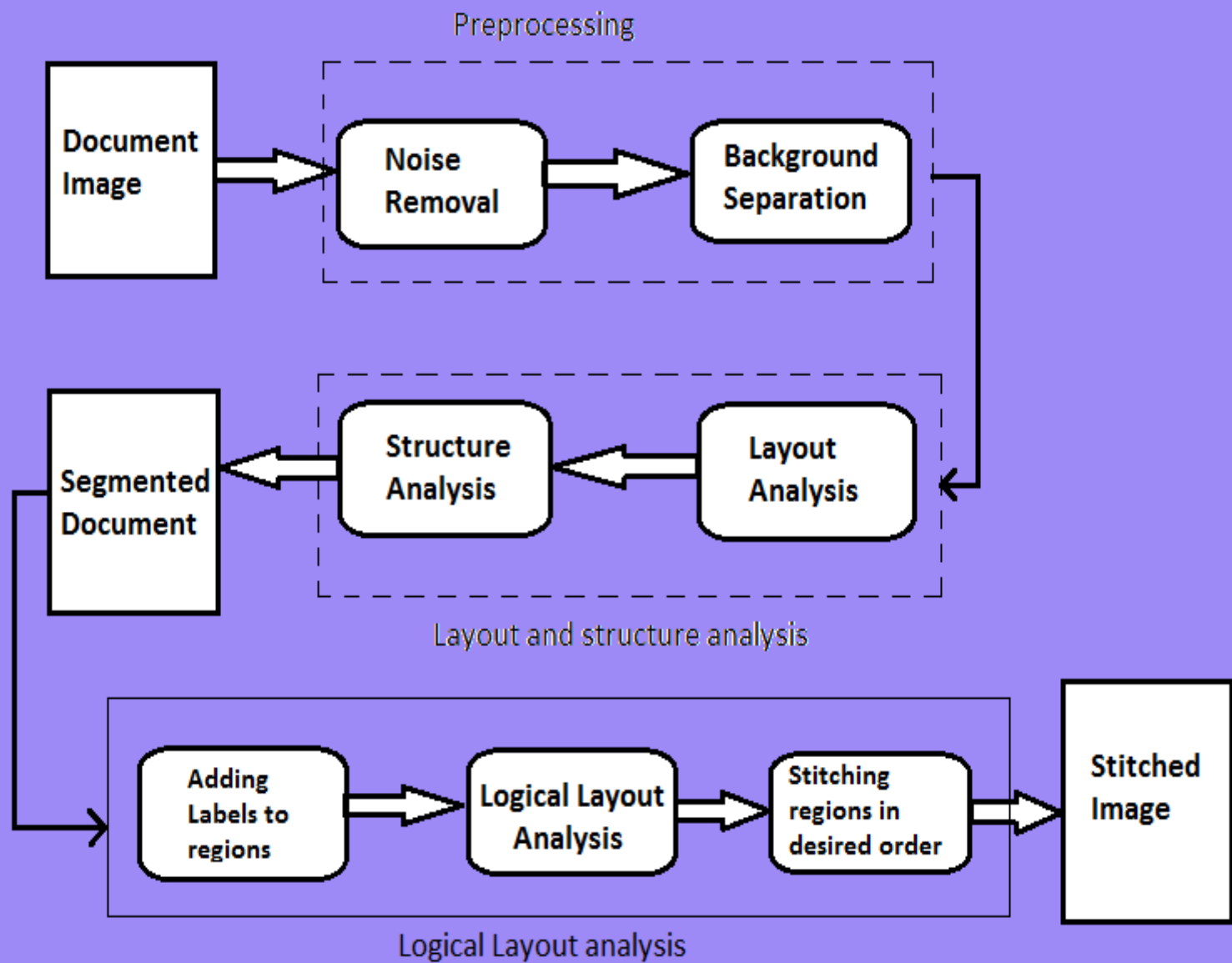
"We have a lot of natural resources, but unfortunately the area is still unexplored," he said and sought media's help to promote the tourist destinations of the area, especially the Suppat Valley.



A WATERFALL on Karakoram Highway.—Dawn

Block Diagram/Flow of Work

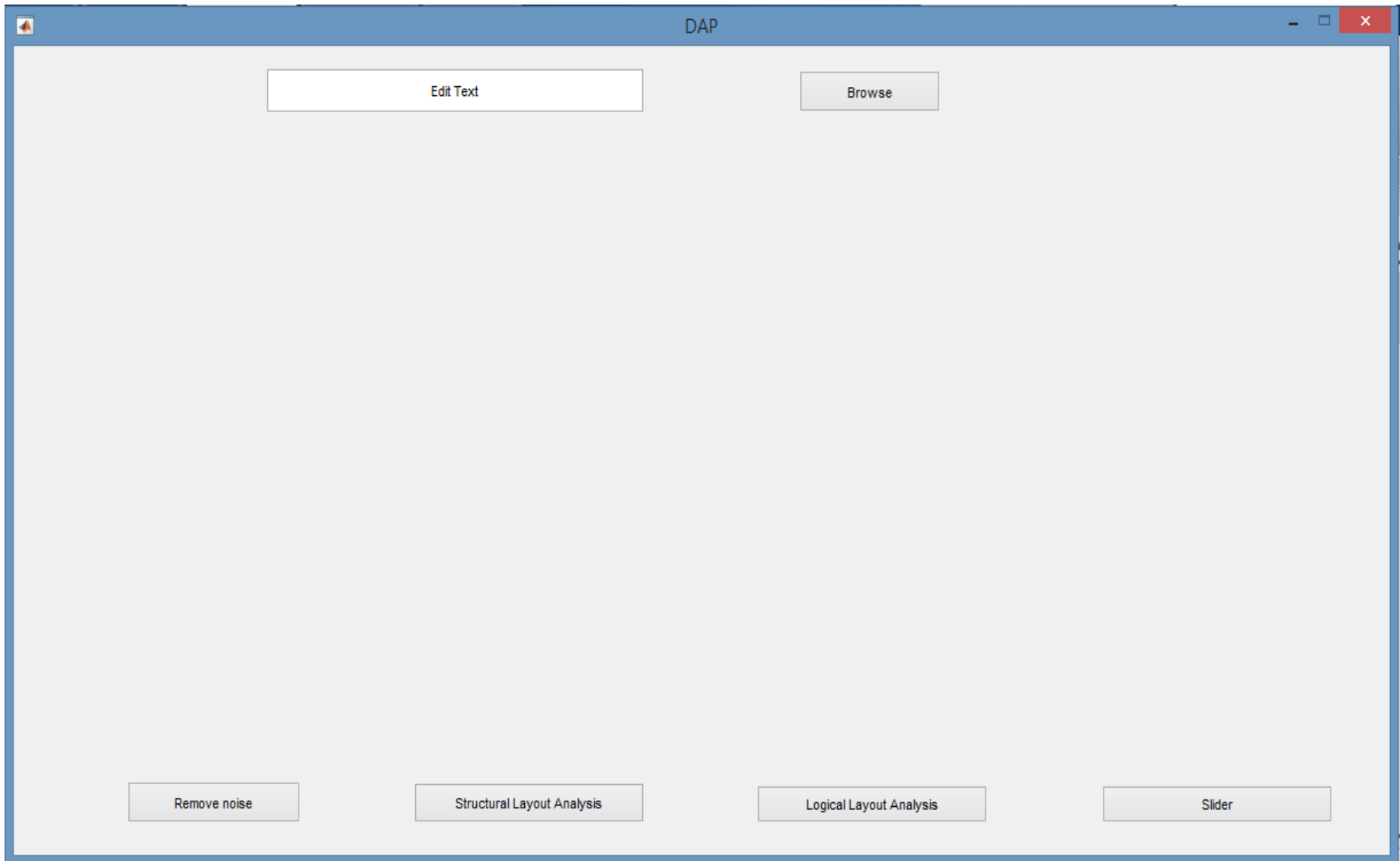
IN THIS SECTION WE DESCRIBED WITH THE HELP OF **BLOCK DIAGRAM**, THE PRINCIPLES WE STUDIED AND APPLY TO INPUT IMAGES TO ADDRESS THE MENTIONED PROBLEM.



GUI

IN THIS SECTION WE SHOW OUR GUI SO THAT VIEWERS CAN UNDERSTAND THE INTERACTION IN BETWEEN INPUT AND OUTPUT.

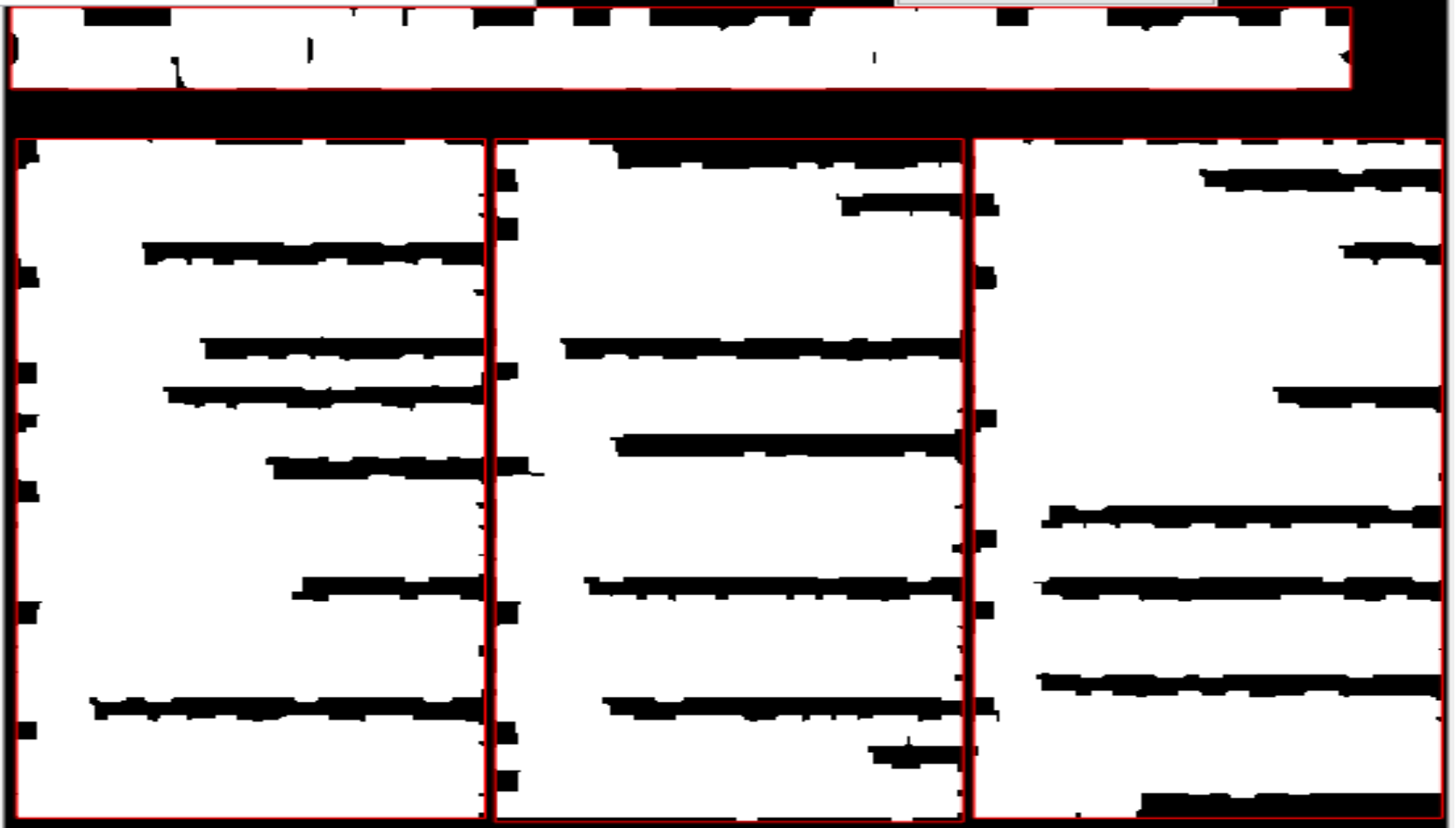
It's a simple GUI in which user have to browse the image for the processing. Results will be shown in the empty space in between.



Results

BEFORE GETTING INTO THE THEORETICAL/MATHEMATICAL DETAILS WE WILL SHOW VIEWERS SOME IMPORTANT RESULTS TO GRASP THE TECHNIQUES AND CONCEPTS.

Dilation (Structural layout)



Labelling (Logical Layout)

Four UN Mali mission staff killed in attack

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BAMAKO: A Chinese peacekeeper and three civilians working for the UN's Mali mission have become the latest casualties of the troubled outfit, the UN and China's foreign ministry said on Wednesday.

The last month alone has seen three attacks on members of the mission, known as MINUSMA, fuelling concern over its future with 65 killed in under three years.

It is the deadliest active deployment for UN peacekeepers.

Al Qaeda's North African affiliate AQIM claimed responsibility for Tuesday's attacks, the US monitoring SITE said.

The MINUSMA camp was targeted in a mortar or rocket attack on Tuesday night, a statement from the mission said, during which "a peacekeeper was killed and and three peacekeepers seriously wounded."

A second armed attack on a UN de-mining unit killed "two security guards and an international expert", said the same statement said, without giving the nationality of the foreigner killed.

It was "the first time a Chinese UN peacekeeper has been killed in the north," an African military source told AFP, adding that among the civilians killed one was French and the two oth-

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ers Malian.

The three peacekeepers seriously wounded were all Chinese, the source added.

Five Togolese peacekeepers were killed in an ambush by unidentified gunmen in central Mali on May 29, and five Chadians died on May 19 when their vehicle hit a landmine and then came under fire by Islamist group Ansar Dine.

Chinese foreign ministry spokeswoman Hua Chunying confirmed the dead peacekeeper was from China, and killed what she called a "terrorist attack".

"This is a grave and outrageous crime, China strongly condemns it, we call for the UN and Mali to carry out a thorough investigation and bring the perpetrators to justice," she told a press conference on Wednesday in Beijing.

Al Qaeda in the Islamic Maghreb meanwhile said that fighters from its "al-Murabitoun battalion engaged in a clash with 'crusader occupation forces'," referring to the UN mission in Mali, SITE said.

The jihadists called it an "epic battle" and said they were "thrashing" the enemy.

Al-Murabitoun, led by one-eyed Algerian militant Mokhtar Belmokhtar, has claimed responsi-

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bility for several spectacular and bloody attacks in sub-Saharan Africa.

The UN deployed helicopters to monitor the area and a rapid reaction force was patrolling Gao, MINUSMA said in its statement.

Mission chief Mahamat Saleh Annadif said he was "disgusted by these vicious, cowardly and totally unacceptable attacks," calling on the Malian government to track down the attackers and bring them to justice. "These crimes can no longer be tolerated," he added.

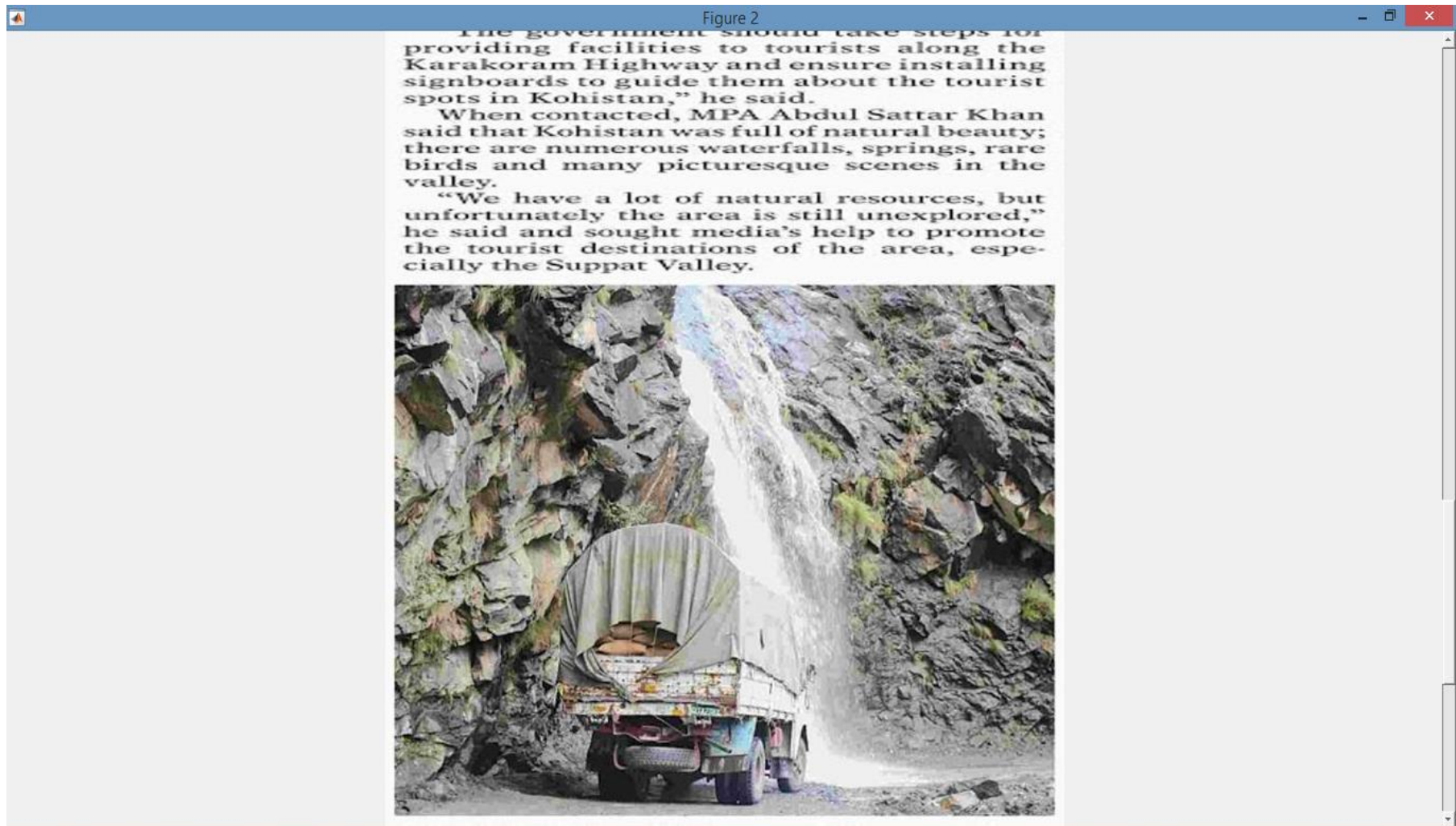
Mali's former colonial ruler France also condemned the attack and said it was "at the side of the Malian authorities and MINUSMA in their efforts to fight terrorism and usher in stability in Mali."

France's Barkhane force has 3,500 soldiers deployed across five Sahel countries, including Mali.

Mali's north has seen repeated violence since it fell under the control of Tuareg-led rebels who allied with jihadist groups linked to Al-Qaeda in 2012.

The Islamists were largely ousted by an ongoing French-led military operation launched in January 2013, but they have since carried out sporadic attacks on security forces from desert hideouts.—AFP

Concatenation of cropped images



Preprocessing

IN THIS SECTION WE DESCRIBED THE
PREPROCESSING APPLIED ON INPUT IMAGES
ALONG WITH NECESSARY MATLAB CODE.

Noise Removal (Halftone)



After applying median filter.



Aspect ratio

Waterfalls add to beauty of Shangla, Kohistan tourist sites

By Umar Bacha

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The large and charming waterfalls originating at 1,000 to 5,000 meters height and falling with a great speed attract large crowds. These are regarded as tourist spots and a large number of domestic and foreign tourists visit them. The tourists also enjoy seeing scenic waterfalls wherever they travel in Gilgit-Baltistan and Hunza.

"The waterfall is really amazing to see besides enjoying cool winds and humming sounds," said Aksha Nauman, a member of a tourist family making snaps with a waterfall at Dassa.

She said that from Bisham to Chilas they had seen many beautiful waterfalls from their vehicle. She said that the Indus River flowing along Karakoram Highway also presents another scenic view.

Ashfaq Ahmed, a tourist from Lahore, said that he had only seen such beautiful water-

falls in movies, but today he enjoyed the panoramic view of the waterfall from atop and its roaring noise punctuated by chirping of birds.

"The government could generate big revenue by developing these waterfalls into proper tourist spots in Shangla and Kohistan districts. There are no such facilities for tourists like hotels here," he said.

A foreign tourist, Adevn Kalam, told this correspondent that he enjoyed seeing natural scenery and the queue of waterfalls along the Karakoram Highway and Indus River besides the lush green mountains. However, he complained that the road from Dassa to Chilas was in a dilapidated condition and created difficulties for tourists.

"The government should take steps for providing facilities to tourists along the Karakoram Highway and ensure installing signboards to guide them about the tourist spots in Kohistan," he said.

When contacted, MPA Abdul Sattar Khan said that Kohistan was full of natural beauty; there are numerous waterfalls, springs, rare birds and many picturesque scenes in the valley.

"We have a lot of natural resources, but unfortunately the area is still unexplored," he said and sought media's help to promote the tourist destinations of the area, especially the Suppat Valley.



A WATERFALL on Karakoram Highway.—Dawn

Original image

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After applying aspect ratio

Foreground detection

- Threshold the image using **graythresh** function.



Algorithm Description

HERE WE DESCRIBES THE KEY STEPS OF
ALGORITHM THAT WE USED FOR IMAGE
SEGMENTATION AND/OR FEATURE EXTRACTION

- Approach: Top-down
- Region segmentation: **regionprops('BoundingBox')**.
- Region classification: Text vs Image using **OCR-based approach**.
- Algorithm: X-Y cut (**imcrop()**)
- Concatenation of images: **cat(cell{ })**

Step 1:

Background separation was done by thresholding and inverting the image.

Step 2:

Structural layout analysis is done by morphological operations.

Step 3:

Logical layout analysis is done by adding labels to the segmented image regions.

Textual and non-textual regions are separated by OCR.

Step 4:

Image stitching is then performed on the segments formed in the previous steps and are placed together vertically with a scrollbar on it.

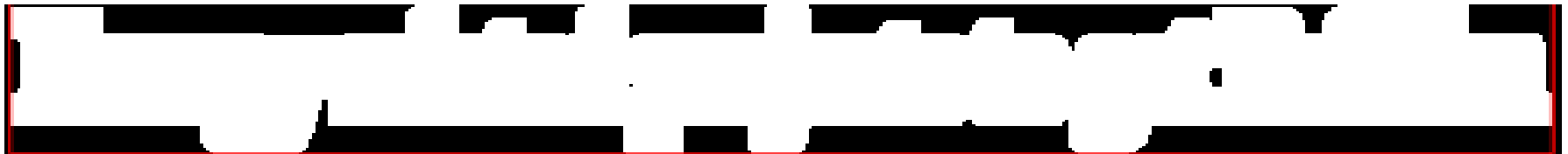
Challenges and difficulties

1. Single Dilation applied in image doesn't work in all images. Especially the head part always need some extra dilation so that it make an unbreakable rectangle.



Solution:

We cropped out the upper portion in which head lies and applied a different structuring element. Put back the cropped part back in its position.



2. To make almost all images of same size.

Solution:

We used the aspect ratio property.

Here the width is fixed and according to that new height is calculated.

%Aspect Ratio

$R=w/h;$

$newh=h*R;$

`img=imresize(img1,[newh 3075]);`

3. To classify between column vs image.

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head

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head

A WATERFALL on Karakoram Highway—Oman

Solution:

We used OCR to distinguish between textual and non textual region.

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Image



head

A WATERFALL on Karakoram Highway—Oman

Learning and Achievements

IN THIS SECTION WE DESCRIBE THE THINGS THAT MAKES US FEEL THAT WE HAVE LEARNED, WE DID SOMETHING NEW , WE DID SOMETHING THAT IS DIFFERENT AND THUS WE SHOULD GET FULL MARKS OR EVEN WE DESERVES BONUS MARKS.

- We tried to build a document understanding system , something we never heard and thought of before this course.
- We have learned the basics of physical and logical layout of a newspaper.
- We can crop the region of interest and put it back in their original position after applying some processing in order to work partially on that image.
- Also, we can reduce the time of processing by making it efficient.
- How to deal with different types of images.
- Learned to code on MATLAB.

Improvements and future work

IN THIS SECTION WE MENTION THE TASKS THAT ARE STILL UNRESOLVED. THE EXCEPTIONAL CASES WHERE STILL IMPROVEMENT IS NEEDED. WE ALSO MENTION THE APPLICATIONS THAT CAN BUILD ON TOP OF OUR CURRENT WORK.

Improvement

- There is need of tuning limits of bounding box for further sub divisions like sub-heading, line, word etc.
- Also, a more efficient approach could be applied for concatenation of images so that the cropped images of different size would not matter in the future.

Images with small width can't have a proper dilation, they merge into each other.

Unelected African chiefs make their countries more democratic

By Kate Baldwin

IN Agail, a traditional chief caused a stir in Ghana when he expressed support for the incumbent president, John Mahama, in the country's upcoming presidential election. The same month, two dozen chiefs from northern Zambia allegedly endorsed the re-election of the Zambian president, Edgar Lungu.

Most rural Africans live in communities led by unelected traditional chiefs, and traditional leaders often endorse candidates in African elections. How democratic are countries really be if citizens are still governed by unelected chiefs? Can chiefs pervert the democratic process by coining voters into supporting their preferred candidates?

These questions motivated the research released in my new book, *The Paradox of Traditional Chiefs in Democratic Africa*.

Traditional chiefs have power by virtue of their

roots on the ground.

Specifically, chiefs often lobby for government projects and organise community contributions that complement government investment. Chiefs can organise local volunteers to assist with construction projects or monitor the activities of contractors. With these efforts, more local projects succeed. In this sense, democratic representation is improved.

But why are chiefs uniquely able to connect communities to demand and facilitate local projects? Why can't elected councillors or members of parliament do this as effectively?

Traditional chiefs typically have stronger local-level institutions than they can use to organise information community actions. They have networks of sub-chiefs and village headmen to help them monitor villages, and they run traditional court systems that can discipline non-contributors. Most elected politicians have no comparable local organisation to assist them.

As unelected leaders, chiefs have little political incentive to act in the interest of the majority. But local chiefs often have strong economic and social ties that align their interests with their communities. Chiefs too benefit from local development projects, so they make efforts to broker them even without electoral incentives.

Furthermore, traditional chiefs have stronger local-level institutions than elected politicians in part because they can think further ahead than the next election. Chiefs are willing to make long-term investments in building and maintaining community institutions because they expect to rule for life. Elected politicians aren't as likely to do this. Their tenure in office is more precarious and they are less likely to reap the long-term rewards.

Paradoxically, democratic representation works better through unelected local leaders in rural Africa.

Because they are so central to local development projects, chiefs' political endorsements can also be constructive. A chief can more effectively lobby for resources and collaborate with the government if his (or, rarely, her) preferred candidate is elected. Voters may want to follow their chief's preferred candidate so they can start the politician who will end up serving them best, as I argue in this article.

My book is full of evidence that chiefs can make democratic governments more responsive to rural communities, drawing especially on the case of Zambia. For instance, after chiefs die (but before new leaders step in), fewer new classrooms and boreholes get built. Communities receive more classrooms and road rehabilitation projects when chiefs have stronger relationships with elected politicians. And politically sophisticated voters rely on their chief's endorsements to assess which political candidate will deliver the most to their community.

Traditional chiefs should not be romanticised; they are just as self-interested as elected politicians. But, in Africa's fledgling democracies, chiefs often are far more committed to helping elect politicians serve rural communities than otherwise often assume.

—By arrangement with The Washington Post

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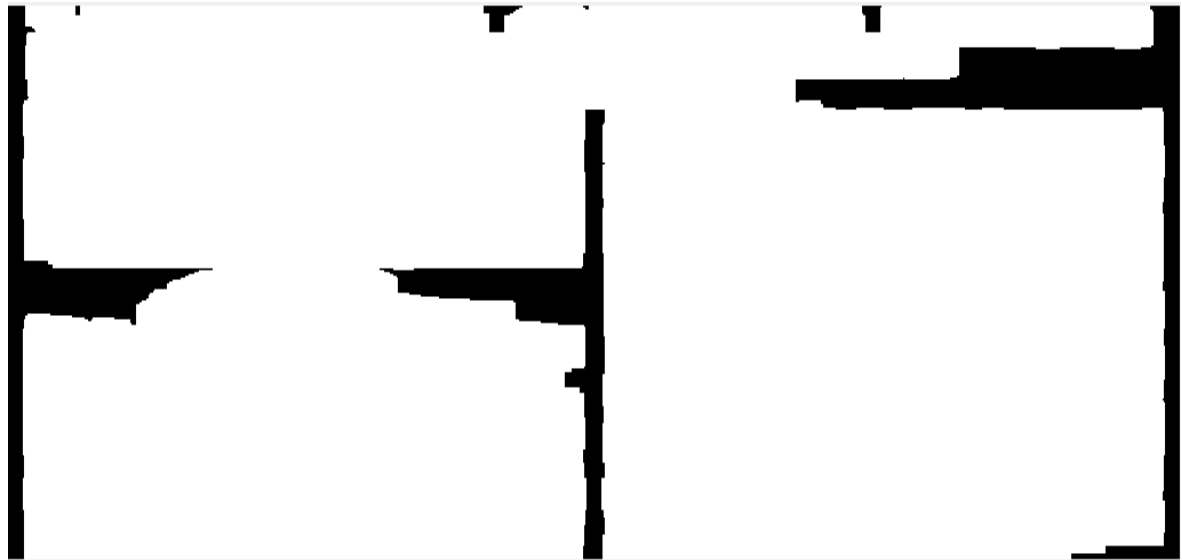
TWO dozen chiefs from northern Zambia allegedly endorsed the re-election of the Zambian president, Edgar Lungu.

connections with community customs. They are typically selected from within local ruling families and rule for life, as some observers are concerned that their continued power undermines democracy.

But I find that traditional chiefs often improve, rather than harm, democratic representation. African chiefs are uniquely positioned to get policymakers to respond to rural voters — not despite being unelected, but because of it.

This surprising claim makes more sense in light of a few facts about African politics. First, not every voter wants their elected representatives to deliver basic infrastructure and public services. They demand schools, health clinics, boreholes and roads for their communities. Second, most African governments are weak. Their administrative presence and power are limited, especially in rural areas. Their budgets are tight. On their own, they are not very good at providing the basic infrastructure projects and services that voters want.

Elected traditional chiefs. They can fill the gaps in the process of translating voters' priorities into pro-



References

1. <https://cvit.iiit.ac.in/papers/DocStructure.pdf>
2. <http://www.mathworks.com/>
3. <http://stackoverflow.com/>

Demo and Queries
