JobSheet 12: Optical Character Recognition (OCR)

Praktikum 1

Instalasi dan Import Library

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Drive already mounted at /content/drive; to attempt to forcibly remount, call drive.mount("/content/drive", force_remount=True).
```

```
!sudo apt install tesseract-ocr
!pip install pytesseract
!pip install opencv-python
```

```
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  tesseract-ocr-eng tesseract-ocr-osd
The following NEW packages will be installed:
  tesseract-ocr tesseract-ocr-eng tesseract-ocr-osd
0 upgraded, 3 newly installed, 0 to remove and 10 not upgraded.
Need to get 4,816 kB of archives.
After this operation, 15.6 MB of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tesseract-ocr-eng all 1:4.00~git30-7274cfa-1.1 [1,591 kB]
Get:2 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tesseract-ocr-osd all 1:4.00~git30-7274cfa-1.1 [2,990 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy/universe amd64 tesseract-ocr amd64 4.1.1-2.1build1 [236 kB]
Fetched 4,816 kB in 2s (2,867 kB/s)
debconf: unable to initialize frontend: Dialog
debconf: (No usable dialog-like program is installed, so the dialog based frontend cannot be used. at /usr/share/perl5/Debconf/FrontEnd
debconf: falling back to frontend: Readline
debconf: unable to initialize frontend: Readline
debconf: (This frontend requires a controlling tty.)
debconf: falling back to frontend: Teletype
dpkg-preconfigure: unable to re-open stdin:
Selecting previously unselected package tesseract-ocr-eng.
(Reading database ... 120880 files and directories currently installed.)
Preparing to unpack .../tesseract-ocr-eng_1%3a4.00~git30-7274cfa-1.1_all.deb ...
Unpacking tesseract-ocr-eng (1:4.00~git30-7274cfa-1.1) ...
Selecting previously unselected package tesseract-ocr-osd.
Preparing to unpack .../tesseract-ocr-osd_1%3a4.00~git30-7274cfa-1.1_all.deb ...
Unpacking tesseract-ocr-osd (1:4.00~git30-7274cfa-1.1) ...
Selecting previously unselected package tesseract-ocr.
Preparing to unpack .../tesseract-ocr_4.1.1-2.1build1_amd64.deb ...
Unpacking tesseract-ocr (4.1.1-2.1build1) ...
Setting up tesseract-ocr-eng (1:4.00~git30-7274cfa-1.1) ...
Setting up tesseract-ocr-osd (1:4.00~git30-7274cfa-1.1) ...
Setting up tesseract-ocr (4.1.1-2.1build1) ...
Processing triggers for man-db (2.10.2-1) ...
Collecting pytesseract
  Downloading pytesseract-0.3.10-py3-none-any.whl (14 kB)
Requirement already satisfied: packaging>=21.3 in /usr/local/lib/python3.10/dist-packages (from pytesseract) (23.2)
Requirement already satisfied: Pillow>=8.0.0 in /usr/local/lib/python3.10/dist-packages (from pytesseract) (9.4.0)
Installing collected packages: pytesseract
Successfully installed pytesseract-0.3.10
Requirement already satisfied: opencv-python in /usr/local/lib/python3.10/dist-packages (4.8.0.76)
Requirement already satisfied: numpy>=1.21.2 in /usr/local/lib/python3.10/dist-packages (from opencv-python) (1.23.5)
```

```
from zipfile import ZipFile
with ZipFile('/content/drive/MyDrive/pcvk/images-ocr.zip', 'r') as zipobj:
  zipobj.extractall('/content/drive/MyDrive/PCVK/images')
```

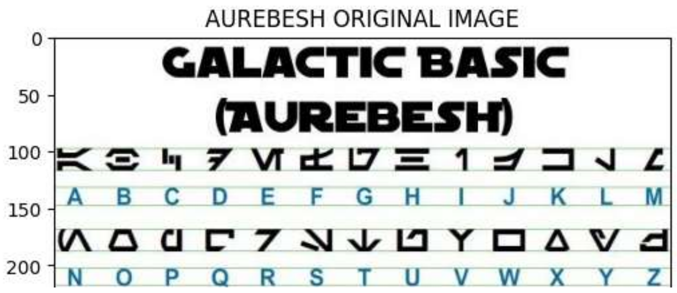
```
import re
import cv2
import numpy as np
import pytesseract
from pytesseract import Output
from matplotlib import pyplot as plt
```

```
IMG_DIR = 'images/'
```

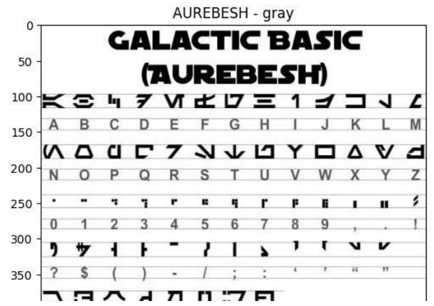
Preprocessing images dengan OpenCV

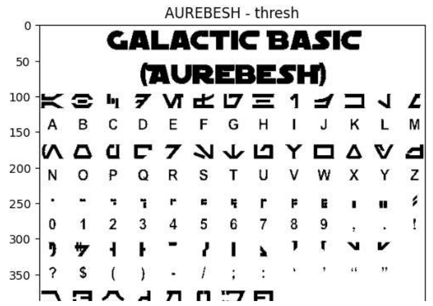
```
# get grayscale image
def get_grayscale(image):
    return cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

# noise removal
def remove_noise(image):
    return cv2.medianBlur(image,5)

#thresholding
def thresholding(image):
    return cv2.threshold(image, 0, 255, cv2.THRESH_BINARY + cv2.THRESH_OTSU)[1]

#dilation
def dilate(image):
    kernel = np.ones((5,5),np.uint8)
    return cv2.dilate(image, kernel, iterations = 1)

#erosion
def erode(image):
    kernel = np.ones((5,5),np.uint8)
    return cv2.erode(image, kernel, iterations = 1)

#opening - erosion followed by dilation
def opening(image):
    kernel = np.ones((5,5),np.uint8)
    return cv2.morphologyEx(image, cv2.MORPH_OPEN, kernel)

#canny edge detection
def canny(image):
    return cv2.Canny(image, 100, 200)

#skew correction
def deskew(image):
    coords = np.column_stack(np.where(image > 0))
    angle = cv2.minAreaRect(coords)[-1]
    if angle < -45:
        angle = -(90 + angle)
    else:
        angle = -angle
    (h, w) = image.shape[:2]
    center = (w // 2, h // 2)
    M = cv2.getRotationMatrix2D(center, angle, 1.0)
    rotated = cv2.warpAffine(image, M, (w, h), flags=cv2.INTER_CUBIC, borderMode=cv2.BORDER_REPLICATE)
    return rotated

#template matching
def match_template(image, template):
    return cv2.matchTemplate(image, template, cv2.TM_CCOEFF_NORMED)
```

```
# Plot original image

IMG_DIR = '/content/drive/MyDrive/images'  # Definisikan path direktori gambar di sini
img = cv2.imread(IMG_DIR + '/aurebesh.jpg')
b,g,r = cv2.split(img)
rgb_img = cv2.merge([r,g,b])
plt.imshow(rgb_img)
plt.title('AUREBESH ORIGINAL IMAGE')
plt.show()
```



```
# Preprocess image

gray = get_grayscale(img)
thresh = thresholding(gray)
opening = opening(gray)
canny = canny(gray)
images = {'gray': gray,
          'thresh': thresh,
          'opening': opening,
          'canny': canny}


# Plot images after preprocessing

fig = plt.figure(figsize=(13,13))
ax = []

rows = 2
columns = 2
keys = list(images.keys())
for i in range(rows*columns):
    ax.append( fig.add_subplot(rows, columns, i+1) )
    ax[-1].set_title('AUREBESH - ' + keys[i])
    plt.imshow(images[keys[i]], cmap='gray')
```





```
# Get OCR output using Pytesseract

custom_config = r'--oem 3 --psm 6'
print('-----------------------------------------')
print('TESSERACT OUTPUT --> ORIGINAL IMAGE')
print('-----------------------------------------')
print(pytesseract.image_to_string(img, config=custom_config))
print('\n-----------------------------------------')
print('TESSERACT OUTPUT --> THRESHOLDED IMAGE')
print('-----------------------------------------')
print(pytesseract.image_to_string(img, config=custom_config))
print('\n-----------------------------------------')
print('TESSERACT OUTPUT --> OPENED IMAGE')
print('-----------------------------------------')
print(pytesseract.image_to_string(img, config=custom_config))
print('\n-----------------------------------------')
print('TESSERACT OUTPUT --> CANNY EDGE IMAGE')
print('-----------------------------------------')
print(pytesseract.image_to_string(img, config=custom_config))
```

```
st
ASaSAnNADIE
CH AE EO KH NG OO SH TH


-----------------------------------------
TESSERACT OUTPUT --> THRESHOLDED IMAGE
-----------------------------------------
GALACTIC BASIC
(AUREBESH)

RE TFVMVEVEStZIoNe
AB CD EF Ga KL
AOderT7NVYoYoOoOAVA
N_ Oo. 2 _ HG: Re SS Ty wee Ve
Ss eg ei
ed
i a a Sy ee ee ee
st
ASaSAnNADIE
CH AE EO KH NG OO SH TH


-----------------------------------------
TESSERACT OUTPUT --> OPENED IMAGE
-----------------------------------------
GALACTIC BASIC
(AUREBESH)

RE TFVMVEVEStZIoNe
AB CD EF Ga KL
AOderT7NVYoYoOoOAVA
N_ Oo. 2 _ HG: Re SS Ty wee Ve
Ss eg ei
ed
```

```
AB CD EF Ga KL
AOderT7NVYoYoOoOAVA
N_ Oo. 2 _ HG: Re SS Ty wee Ve
Ss eg ei
ed
i a a Sy ee ee ee
st
ASaSAnNADIE
CH AE EO KH NG OO SH TH
```

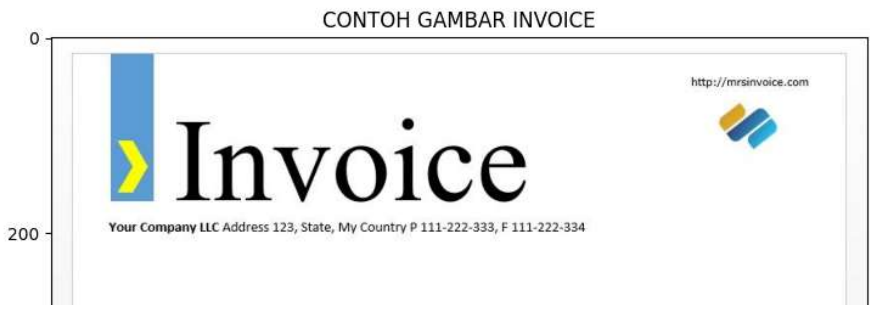
PRAKTIKUM 2

```
from google.colab import files
upload = files.upload()
```

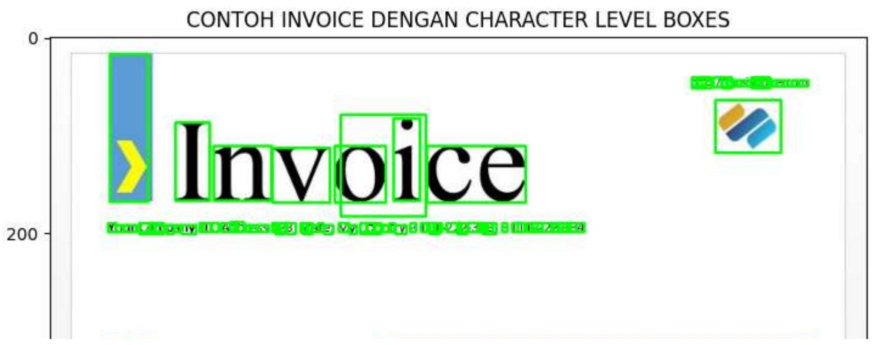
Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving invoice-sample.jpg to invoice-sample.jpg
```

```
# Plot gambar original

# Membaca gambar dari direktori
image = cv2.imread('invoice-sample.jpg')

# Memisahkan saluran warna (blue, green, red) karena matplotlib menggunakan skema warna RGB
b, g, r = cv2.split(image)
rgb_img = cv2.merge([r, g, b])

# Menampilkan gambar dalam ukuran tertentu
plt.figure(figsize=(16, 12))
plt.imshow(rgb_img)
plt.title('CONTOH GAMBAR INVOICE')
plt.show()
```


CONTOH GAMBAR INVOICE
0
200
http://mrsinvoice.com
Invoice
Your Company LLC Address 123, State, My Country P 111-222-333, F 111-222-334

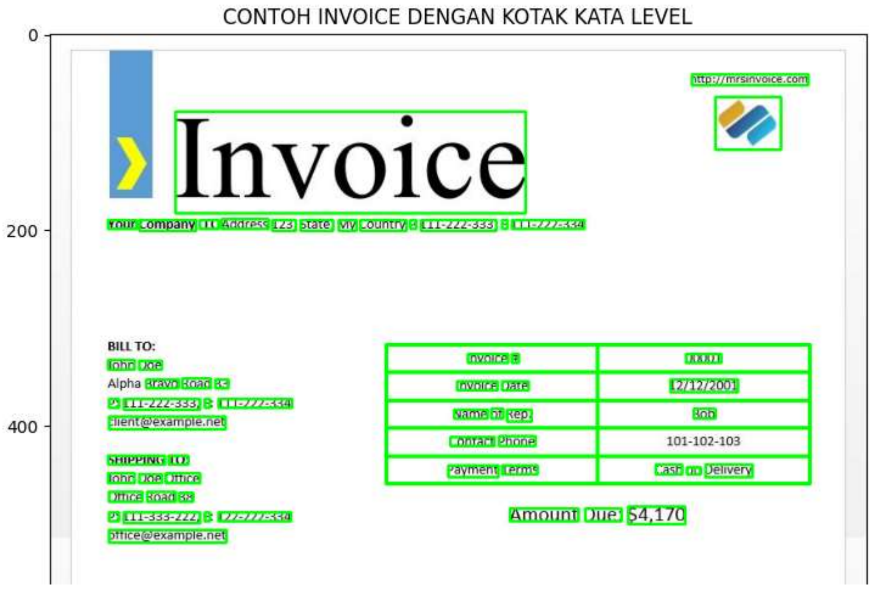
```
# Membaca gambar dari direktori
image = cv2.imread( 'invoice-sample.jpg')

# Mendapatkan dimensi tinggi (h), lebar (w), dan channel warna (c) dari gambar
h, w, c = image.shape

# Menggunakan pytesseract.image_to_boxes() untuk mendapatkan informasi kotak karakter
boxes = pytesseract.image_to_boxes(image)

# Iterasi melalui setiap baris hasil dan membuat kotak pada gambar menggunakan OpenCV
for b in boxes.splitlines():
    b = b.split(' ')
    image = cv2.rectangle(image, (int(b[1]), h - int(b[2])), (int(b[3]), h - int(b[4])), (0, 255, 0), 2)

# Memisahkan channel warna untuk mengonversi dari BGR ke RGB
b, g, r = cv2.split(image)
rgb_img = cv2.merge([r, g, b])

# Menampilkan gambar dengan kotak karakter
plt.figure(figsize=(16, 12))
plt.imshow(rgb_img)
plt.title('CONTOH INVOICE DENGAN CHARACTER LEVEL BOXES')
plt.show()
```



```
# Membaca gambar contoh invoice
image = cv2.imread( 'invoice-sample.jpg')

# Menggunakan pytesseract.image_to_data() untuk mendapatkan data teks dari gambar
d = pytesseract.image_to_data(image, output_type=Output.DICT)

# Menampilkan kunci-kunci data yang diperoleh dari hasil OCR
print('DATA KEYS: \n', d.keys())
```

```
     DATA KEYS:
      dict_keys(['level', 'page_num', 'block_num', 'par_num', 'line_num', 'word_num', 'left', 'top', 'width', 'height', 'conf', 'text'])
```

```
n_boxes = len(d['text'])
for i in range(n_boxes):
    # Kondisi untuk hanya memilih kotak dengan kepercayaan > 60%
    if int(d['conf'][i]) > 60:
        # Mendapatkan koordinat dan ukuran kotak kata
        (x, y, w, h) = (d['left'][i], d['top'][i], d['width'][i], d['height'][i])
        # Membuat kotak pada gambar untuk kata dengan kepercayaan > 60%
        image = cv2.rectangle(image, (x, y), (x + w, y + h), (0, 255, 0), 2)

# Memisahkan channel warna untuk mengonversi dari BGR ke RGB
b, g, r = cv2.split(image)
rgb_img = cv2.merge([r, g, b])

# Menampilkan gambar dengan kotak kata berdasarkan kepercayaan > 60%
plt.figure(figsize=(16, 12))
plt.imshow(rgb_img)
plt.title('CONTOH INVOICE DENGAN KOTAK KATA LEVEL')
plt.show()
```



http://mrsinvoice.com

Invoice

Your Company 11 Address 123 State My Country P 111-222-333 F 111-222-334

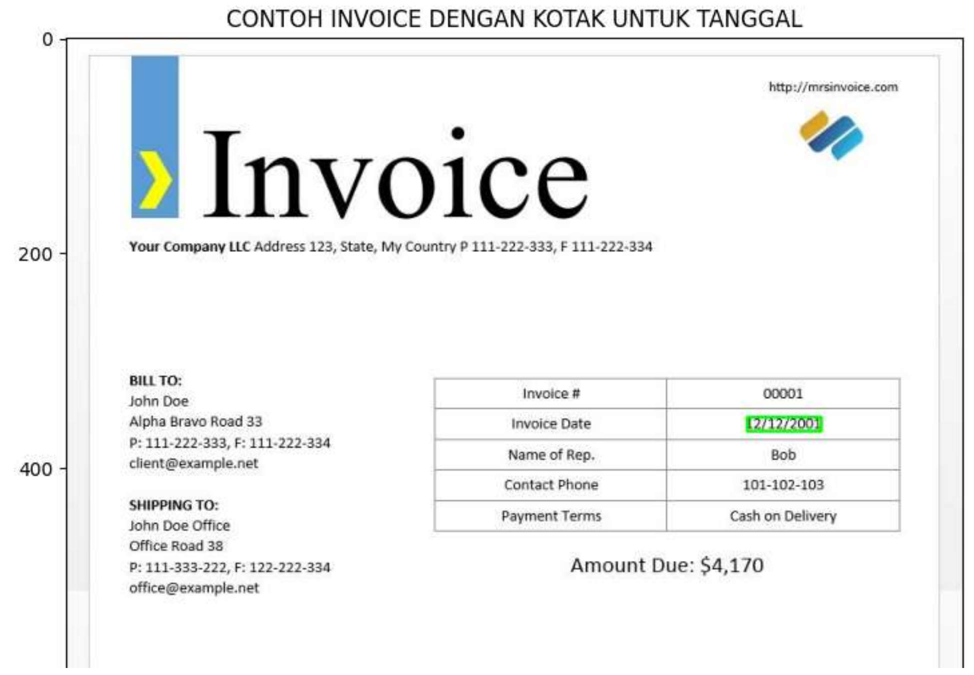
BILL TO:
John Doe
Alpha Bravo Road 33
P 111-222-333 F 111-222-334
client@example.net

SHIPPING TO:
John Doe Office
Office Road 38
P 111-333-222 F 122-222-334
office@example.net

Invoice #	00001
Invoice Date	12/12/2001
Name of Rep.	Bob
Contact Phone	101-102-103
Payment Terms	Cash on Delivery

Amount Due: $4,170

```
image = cv2.imread( 'invoice-sample.jpg')

# Pola tanggal dalam format dd/mm/yyyy
date_pattern = '^(0[1-9]|[12][0-9]|3[01])/(0[1-9]|1[012])/(19|20)\d\d$'

n_boxes = len(d['text'])
for i in range(n_boxes):
    # Memeriksa apakah kotak memiliki tingkat kepercayaan lebih dari 60%
    if int(d['conf'][i]) > 60:
        # Memeriksa apakah teks di dalam kotak sesuai dengan pola tanggal
        if re.match(date_pattern, d['text'][i]):
            # Mendapatkan koordinat dan ukuran kotak kata
            (x, y, w, h) = (d['left'][i], d['top'][i], d['width'][i], d['height'][i])
            # Membuat kotak pada gambar untuk tanggal yang sesuai dengan pola
            image = cv2.rectangle(image, (x, y), (x + w, y + h), (0, 255, 0), 2)

# Memisahkan channel warna untuk mengonversi dari BGR ke RGB
b, g, r = cv2.split(image)
rgb_img = cv2.merge([r, g, b])

# Menampilkan gambar dengan kotak-kotak yang menandai lokasi tanggal
plt.figure(figsize=(16, 12))
plt.imshow(rgb_img)
plt.title('CONTOH INVOICE DENGAN KOTAK UNTUK TANGGAL')
plt.show()
```


CONTOH INVOICE DENGAN KOTAK UNTUK TANGGAL

http://mrsinvoice.com

Invoice

Your Company LLC Address 123, State, My Country P 111-222-333, F 111-222-334

BILL TO:
John Doe
Alpha Bravo Road 33
P: 111-222-333, F: 111-222-334
client@example.net

SHIPPING TO:
John Doe Office
Office Road 38
P: 111-333-222, F: 122-222-334
office@example.net

Invoice #	00001
Invoice Date	12/12/2001
Name of Rep.	Bob
Contact Phone	101-102-103
Payment Terms	Cash on Delivery

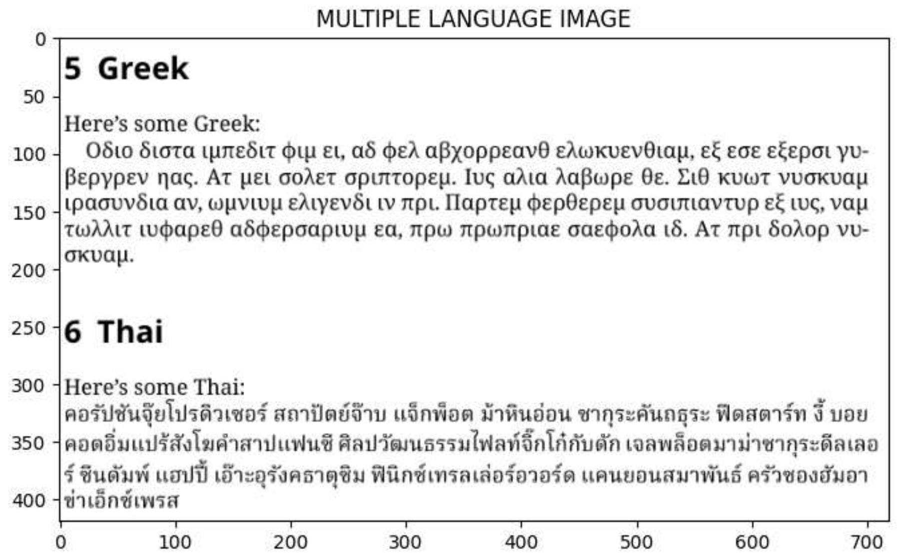
Amount Due: $4,170

```
from google.colab import files
upload = files.upload()
```

Choose Files No file chosen Upload widget is only available when the cell has been executed in the current browser session. Please rerun this cell to enable.

```
Saving greek-thai.png to greek-thai.png
```

```
# Membaca gambar asli
image = cv2.imread( 'greek-thai.png')

# Memisahkan channel warna untuk mengonversi dari BGR ke RGB
b, g, r = cv2.split(image)
rgb_img = cv2.merge([r, g, b])

# Menampilkan gambar asli
plt.figure(figsize=(8, 16))
plt.imshow(rgb_img, cmap='gray')
plt.title('MULTIPLE LANGUAGE IMAGE')
plt.show()
```


MULTIPLE LANGUAGE IMAGE

5 Greek

Here's some Greek:
Οδιο διστα ιμπεδιτ φιμ ει, αδ φελ αβχορρεανθ ελωκυενθιαμ, εξ εσε εξερσι γυβεργρεν ηας. Ατ μει σολετ σριπτορεμ. Ιυς αλια λαβωρε θε. Σιθ κυωτ νυσκυαμ ιρασυνδια αν, ωμνιυμ ελιγενδι ιν πρι. Παρτεμ φερθερεμ συσιπιαντυρ εξ ιυς, ναμ τωλλιτ ιυφαρεθ αδφερσαριυμ εα, πρω πρωπριαε σαεφολα ιδ. Ατ πρι δολορ νυσκυαμ.

6 Thai

Here's some Thai:
คอรัปชันจุ๊ยโปรดิวเซอร์ สถาปัตย์จ๊าบ แจ็กพ็อต ม้าหินอ่อน ซากุระคันถธุระ ฟิดสตาร์ท งี้ บอยคอตอิ่มแปร้สังโฆคำสาปแฟนซี ศิลปวัฒนธรรมไฟลท์จิ๊กโก๋กับตัก เจลพล็อตมาม่าซากุระดีลเลอร์ ซินดัมพ์ แฮปปี้ เอ๊าะอุรังคธาตุซิม ฟินิกซ์เทรลเล่อร์อวอร์ด แคนยอนสมาพันธ์ ครัวซองฮัมอาข่าเอ็กซ์เพรส

```
# Output dengan hanya bahasa Inggris yang ditentukan

# Konfigurasi khusus dengan hanya bahasa Inggris yang diatur
custom_config = r'-l eng --oem 3 --psm 6'

# Menggunakan pytesseract.image_to_string() untuk mendapatkan teks dari gambar dengan konfigurasi khusus
print(pytesseract.image_to_string(image, config=custom_config))
```

```
5 Greek
Here’s some Greek:

OSto Stota tuMedit Huy et, aS ea aByoppeave edAwkvevOuay, e§ ece efepot yu-
Bepypev nas. AT Wel GoAET apiTtopen. Tug aAta AaBwpe Ve. LO KUWT VUoKLaL
(paovvéia av, WUVLUU eAtyevil tv mpL TMaptep bepSepey GvaTLAaVTUp e€€ LUG, Va
TWAALT LUdaped ASdepoapluy Ea, TOW TpwTplae Gaedoda 16. AT mpt SoAop vv-
oxvau.

6 Thai

Here’s some Thai: .
aosUsugulushawos amiaddw usntioa sinfudou winszduagss Haaonsn 3 vos
Aonduusaladrawunud AavTausssulwavianlAdudn wandoamnsiwinsedataa
$ Guduvi woud rvaseasiadu Windinsadosor0sa uausouanrwus aswouduer
didadinsa
```