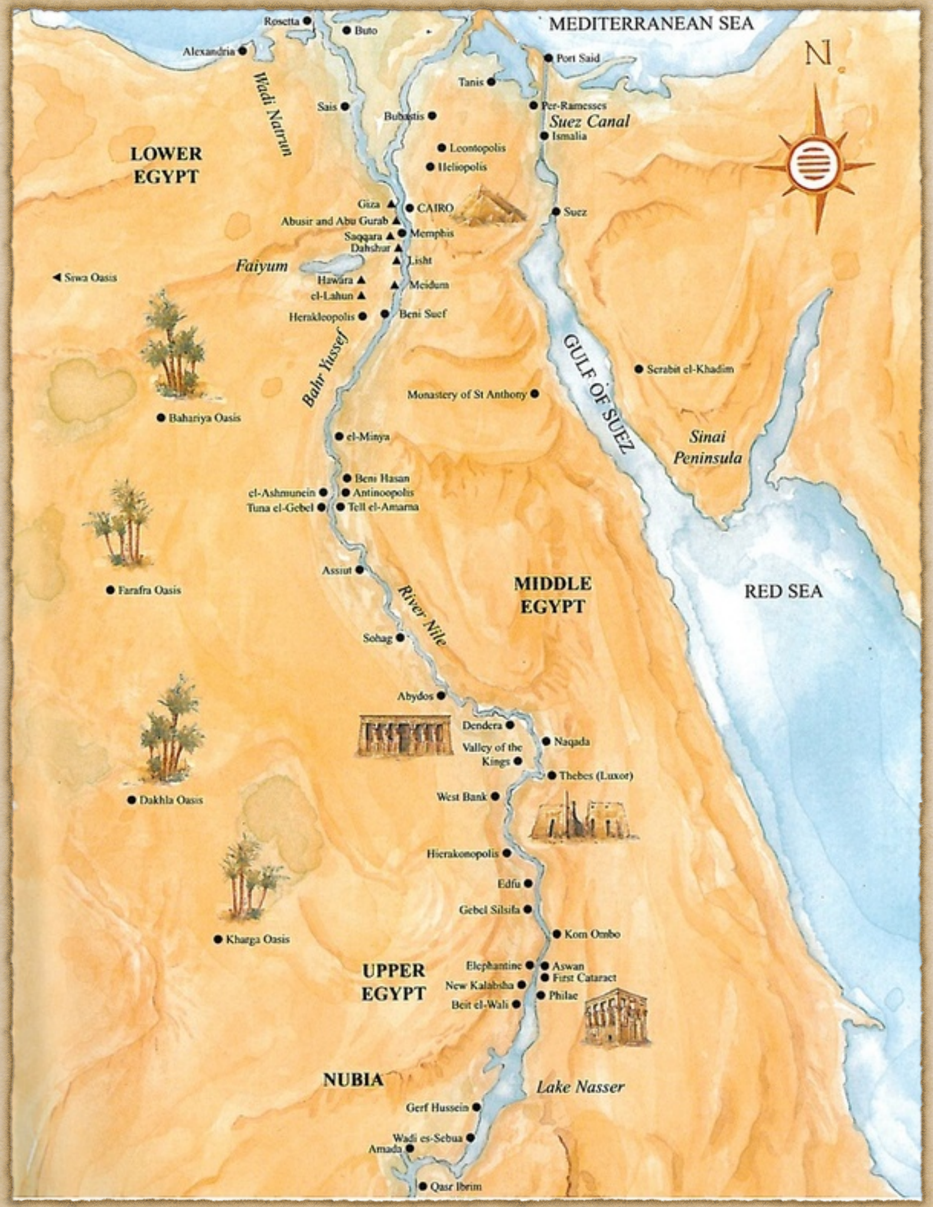
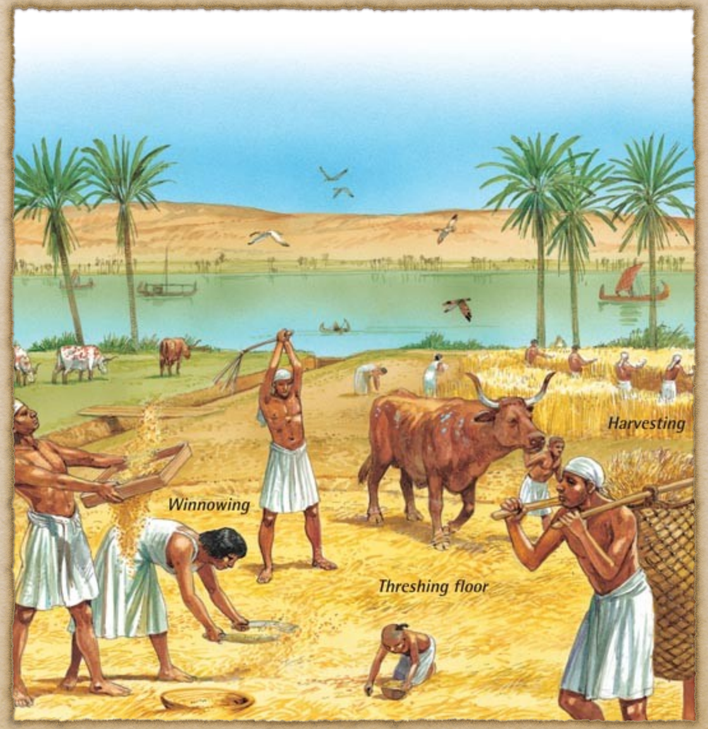
Egyptian Hieroglyphic Recognition

Group 2


Ancient Egypt


MEDITERRANEAN SEA
N
Rosetta
Buto
Alexandria
Wadi Natrun
Port Said
Tanis
Sais
Per-Ramesses
Buhastis
Suez Canal
Ismalia
LOWER EGYPT
Leontopolis
Heliopolis
Giza
CAIRO
Suez
Abusir and Abu Gurab
Saqqara
Memphis
Dahshur
Lisht
Faiyum
Siwa Oasis
Hawara
Meidum
el-Lahun
Herakleopolis
Beni Suef
Bahr Yussef
GULF OF SUEZ
Serabit el-Khadim
Monastery of St Anthony
Bahariya Oasis
el-Minya
Sinai Peninsula
Beni Hasan
el-Ashmunein
Antinoopolis
Tuna el-Gebel
Tell el-Amarna
Farafra Oasis
Assiut
MIDDLE EGYPT
RED SEA
River Nile
Sohag
Abydos
Dendera
Naqada
Valley of the Kings
Thebes (Luxor)
Dakhla Oasis
West Bank
Hierakonopolis
Edfu
Gebel Silsila
Kharga Oasis
Kom Ombo
UPPER EGYPT
Elephantine
Aswan
First Cataract
New Kalabsha
Philae
Beit el-Wali
NUBIA
Lake Nasser
Gerf Hussein
Wadi es-Sebua
Amada
Qasr Ibrim


River Nile
Fishing
Hunting birds
Cattle
Grain store
Winnowing (removing husks)
Irrigation channel
Threshing floor (where grain is separated from


Harvesting
Winnowing
Threshing floor

Egyptian Hieroglyphic

seated man

Egyptian vulture

cobra

sedge

ripple of water

Pipeline

- Image Segmentation for hieroglyphics on Ancient Egyptian slate.
- Recognition for the hieroglyphic.

Image Segmentation

- We created our dataset by labeling the slate image with Labelme tool.

Image Segmentation

- We did transfer learning on pre-trained Solo network model.

The segmentation result is bad. So we decided to segment hieroglyphics manually.

Recognition

Stage 1: Category Classifying

Bird

Plant

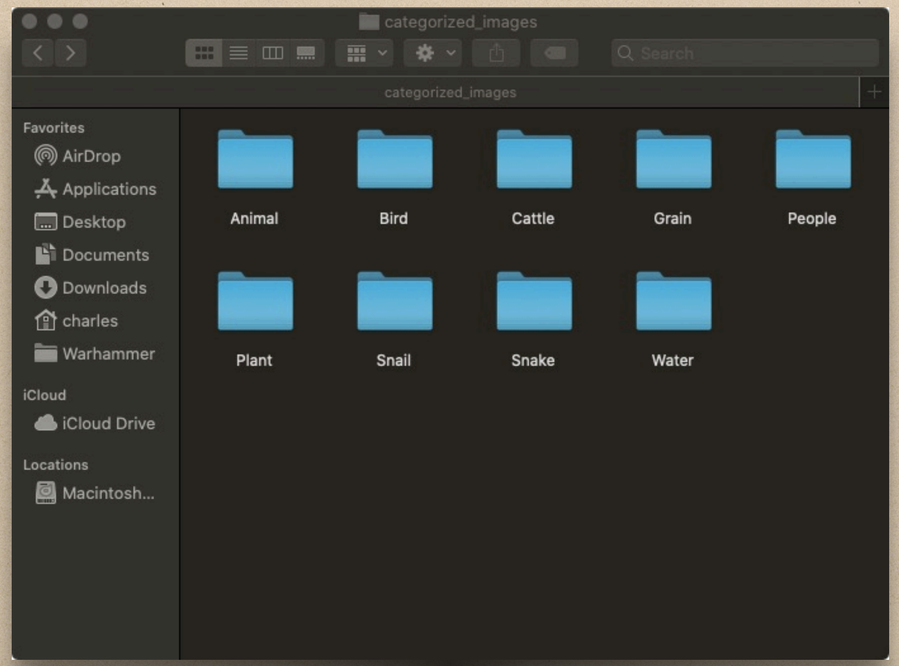
People

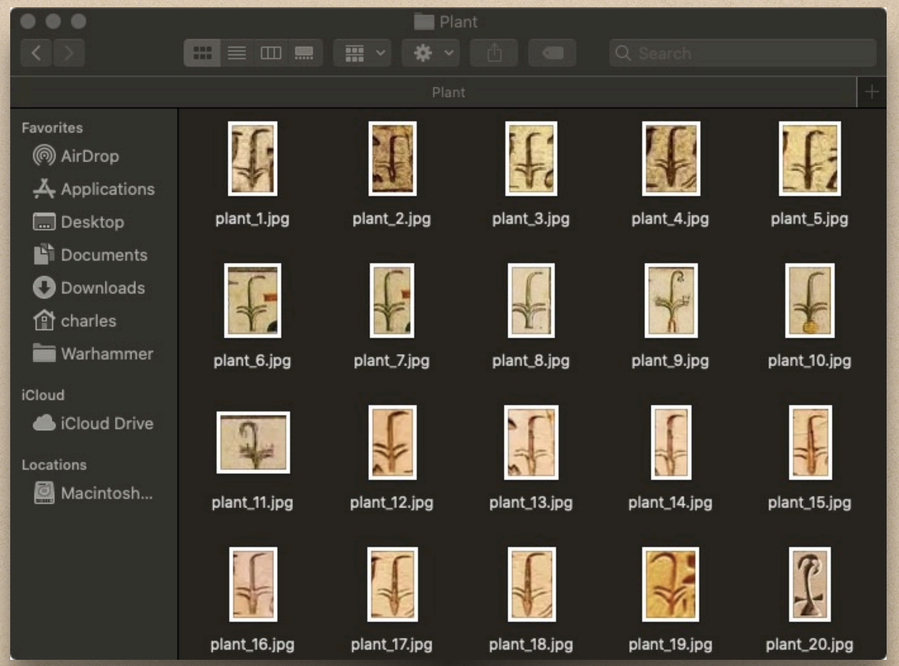
...

Stage 2: Character Mapping

Recognition — Stage 1: Category classifying

- We did transfer learning on pre-trained ResNet-50 model.





Recognition — Category classifying

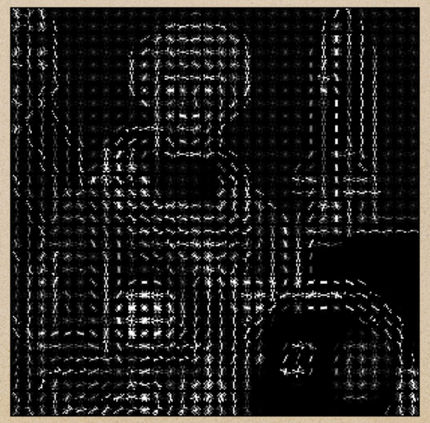
- Training result:

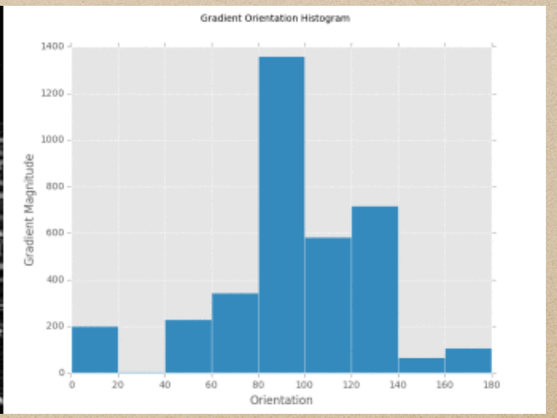
```
charles@liangzhiyuandeMacBook-Air Desktop % python3 test.py -model ./model/resnet50.pth

./model/resnet50.pth is loaded.
Accuracy for class Snail is: 33.3 % (1 / 3)
Accuracy for class Water is: 100.0 % (11 / 11)
Accuracy for class Plant is: 83.3 % (5 / 6)
Accuracy for class Cattle is: 100.0 % (3 / 3)
Accuracy for class Grain is: 100.0 % (6 / 6)
Accuracy for class Bird  is: 90.5 % (19 / 21)
Accuracy for class People is: 37.5 % (3 / 8)
Accuracy for class Animal is: 33.3 % (1 / 3)
Accuracy for class Snake is: 0.0 % (0 / 2)
charles@liangzhiyuandeMacBook-Air Desktop %
```

Recognition — Stage 2: Character Mapping

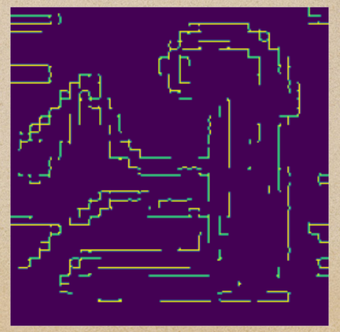
- We map the image into the character with the smallest difference.
- Image feature description:
  - Histogram of Oriented Gradient (HOG)





Recognition — Stage 2: Character Mapping

- Difference between two images
  - Intuitive formulation: hog_diff_original
    - Issue: Input image may be very noisy
    - Solution: Extract area of interest with canny edge detection

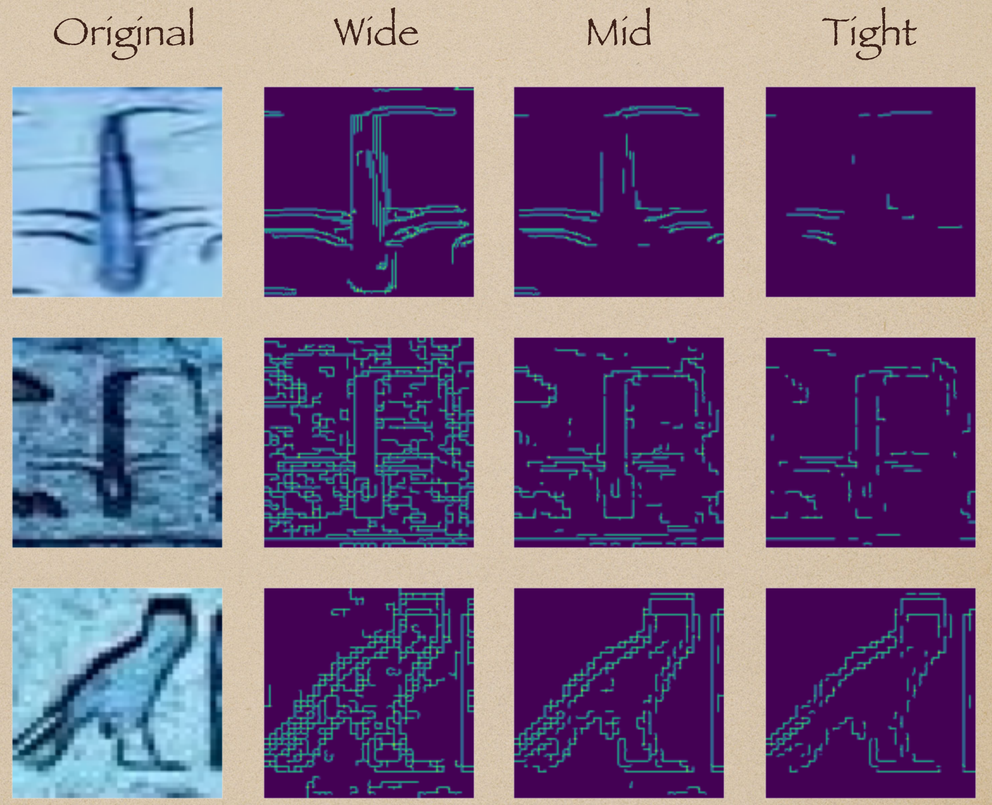



Recognition — Stage 2: Character Mapping

- Difference between two images
  - Our formulation: diff1* 0.4 + diff2 * 0.6
    - diff1: difference between hog on original images
    - diff2 difference between hog on edge images

Recognition — Stage 2: Character Mapping

- Comparisons on three scales
- diff2 = min(
  - hog_diff_edge_wide,
  - hog_diff_edge_mid,
  - hog_diff_edge_tight)



Demo