



Pill Image Recognition Challenge



The need

- Disaster and emergency situations
 - Identify unknown medications
- Consumer health
 - Verify that proper medication was dispensed

The solution

- Using a smart phone equipped with the NLM Pill App, take a picture of the unknown pill
- Wait less than 15 seconds
 - App sends picture to NLM and receives pill identification and supporting information
- App displays pill identification including NLM database pill image and essential supporting information

The first hurdle

- No open source of pill images
- Create a database of the images of all prescription solid form pharmaceuticals – pills – and their associated metadata
 - About 3,250 images captured to date
 - Given repackaging of generic pills, about 20,000 products are currently represented
 - We believe that 5,000 unique images will allow us to identify at least 85% of the prescribed pill medications

Pill Image Recognition Challenge

- Project overview:
 - Take picture of unknown pill using NLM smartphone app
 - App will automatically send picture to NLM
 - **The Challenge: develop the algorithms that NLM will use to match the unknown product picture to an image in the reference pill picture library**
 - NLM will return the matching pill reference image and its associated pill identification and supporting information to the smartphone app for display

Phase I – RFI – The Pilot

Test of the Challenge Environment

pir.nlm.nih.gov

- February 2 to April 27, 2015
 - NLM provides a series of test pill images and Challenge specifications
 - NLM invites the community to provide a matching program embedded in a virtual computer for NLM to use only to test the proposed Challenge test environment and Challenge specifications – not to test the matching program
- Summer 2015
 - Feedback to participants
 - NLM makes corrections and improvements to the Challenge test environment and specifications

Phase II – The Challenge

- September to November 2015
 - NLM provides a series of test pill images and final Challenge specifications
 - NLM invites the community to submit a matching program imbedded in a virtual computer including the source code following the Challenge specifications
 - NLM tests the submitted matching programs against a sample from the provided images and a series of not previously provided images
- December 2015
 - The program with the most correct matches receives the award

C3PI: Test Image Files

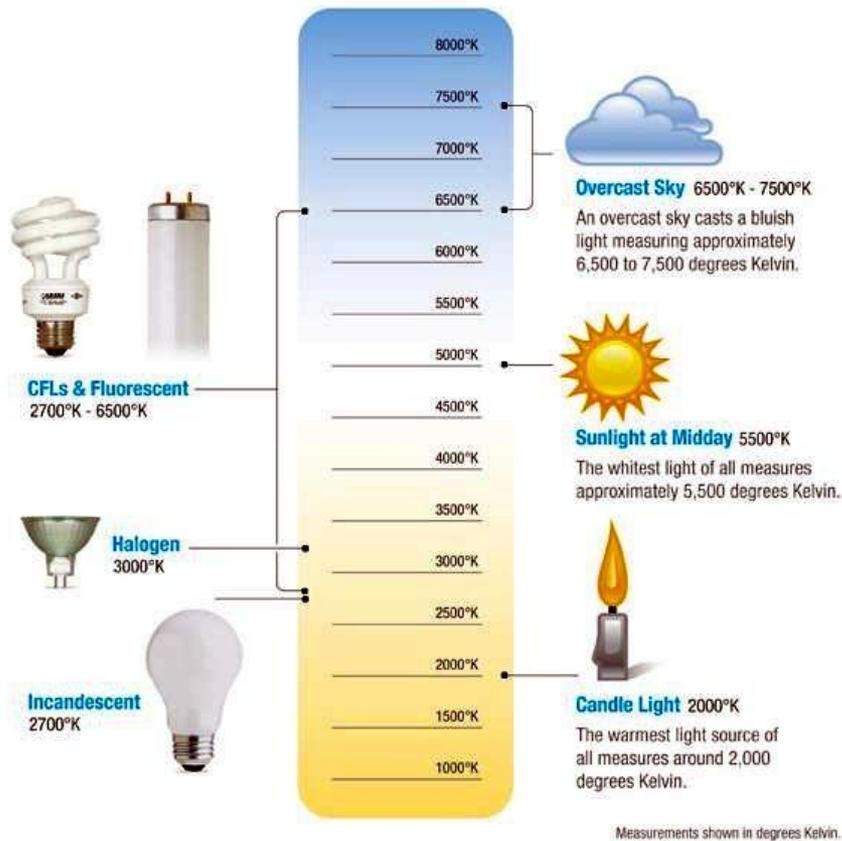
- Category A: Off-Axis Imaging
 - Case #3: Oval and Round OSDF Off-Axis Imaging



White Balance: Automatic
Camera: iPhone 4S
Background: White Paper

C3PI: Test Image Files

- Category B: Varying Illumination



White Balance: Automatic
Camera: Samsung Galaxy S3
Background: White Paper

C3PI: Test Image Files

- Category C: Varying Background



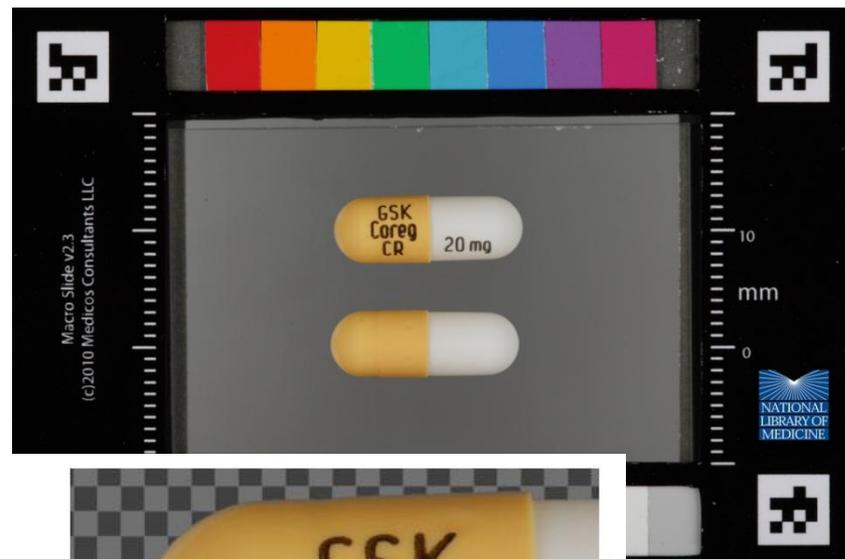
White Balance: Automatic
Camera: Motorola Droid 4
Background: Varied

C3PI: Reference Images

- Non-Polarized and Cross-Polarized Image Acquisition
[NDC 00007-3371]



Non-Polarized



Cross-Polarized

C3PI: Test Image Files

- Category D: Multiple Cameras

[NDC 00071-0530]



White Balance: Automatic
Camera: Nokia Lumina 1020
Background: White Paper



White Balance: Automatic
Camera: Blackberry Curve 8900
Background: Speckled Counter Top

Image Metadata – the data behind the picture may help

Make - Canon

Model - Canon PowerShot S330

Orientation - Top left

X Resolution - 180

Y Resolution - 180

Resolution Unit - Inch

Date Time - 2008:07:08 12:13:41

YCbCr Positioning - Centered

Exif Offset - 196

Exposure Time - 1/80 seconds

F Number - 2.70

Exif Version - 0220

Date Time Original - 2008:07:08 12:13:41

Date Time Digitized - 2008:07:08 12:13:41

Components Configuration - YCbCr

Compressed Bits Per Pixel - 3 (bits/pixel)

Shutter Speed Value - 1/79 seconds

Aperture Value - F 2.70

Exposure Bias Value - 0.00

Max Aperture Value - F 2.70

Metering Mode - Multi-segment

Flash - Not fired, auto mode

Focal Length - 5.41 mm

User Comment -

Flash Pix Version - 0100

Color Space - sRGB

Exif Image Width - 1600

Exif Image Height - 1200

Interoperability Offset - 1412

Focal Plane X Resolution - 7766.99

Focal Plane Y Resolution - 7741.94

Focal Plane Resolution Unit - Inch

Sensing Method - One-chip color area sensor

File Source - DSC - Digital still camera

Custom Rendered - Normal process

Exposure Mode - Auto

White Balance - Auto

Digital Zoom Ratio - 1.00 x

Scene Capture Type - Standard

Maker Note (Vendor) :-

Macro mode - Normal

Self timer - Off

Quality - Fine

Flash mode - Auto

Sequence mode - Single or
Timer

Focus mode - Single

Image size - Large

Easy shooting mode - Full Auto

Digital zoom - None

Contrast - Normal

Saturation - Normal

Sharpness - Normal

ISO Value - Auto

Metering mode - Evaluative

Focus type - Auto

AF point selected - Auto
selected

Exposure mode - Easy shooting

Focal length - 173 - 518 mm (32
mm)

Flash activity -

Flash details -

Focus mode 2 - Single

White Balance - Auto

Sequence number - 1

AF point used - Left

Flash bias - 0.00 EV

Subject Distance - 8772

Image Type - IMG: PowerShot
S330 JPEG

Firmware Version - Firmware
Version 1.00

Image Number - 1242477



Take a picture with your smart phone . . .

[NDC 00185-0101, 00904-5808, 55887-0591]

Filename - IMG-20140417-00129.jpg

Make - Research In Motion

Model - BlackBerry 9810

Orientation - Right top

XResolution - 72

YResolution - 72

ResolutionUnit - Inch

Software - Rim Exif Version1.00a

DateTime - 2014:04:17 18:26:55

YCbCrPositioning - Co-Sited

ExifOffset - 228

ExposureTime - 1/1 seconds

ExifVersion - 0220

DateTimeOriginal - 2014:04:17 18:26:55

ComponentsConfiguration - YCbCr

SubjectDistance - 0 m

LightSource - Auto

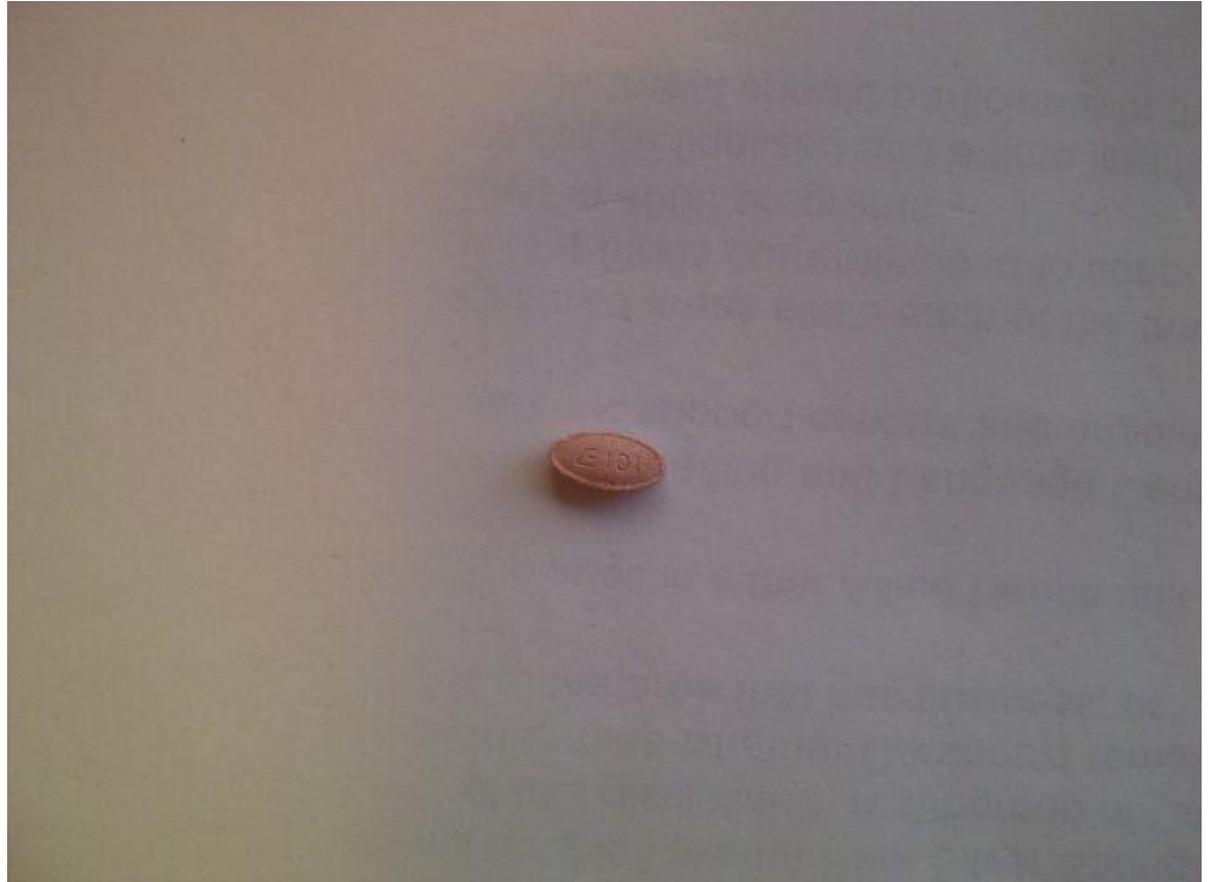
Flash - No flash function

ColorSpace - sRGB

ExifImageWidth - 2560

ExifImageHeight - 1920

DeviceSettingDescription -



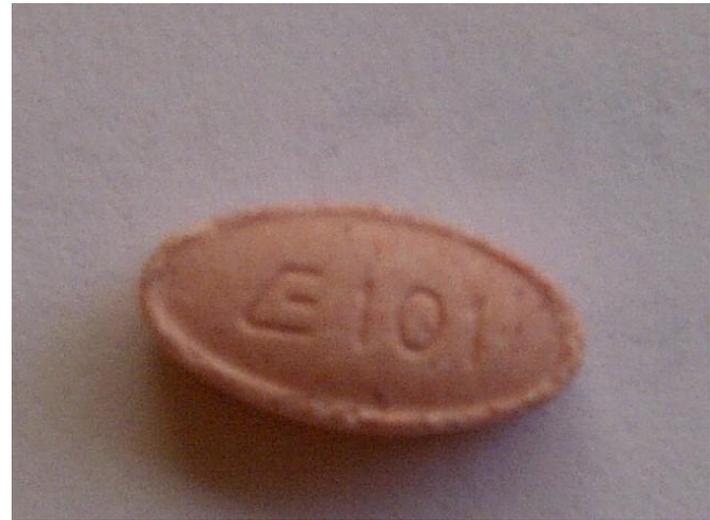
Daylight on white paper

But it should be the right picture!



Post process zoom:
2560 x 1920 --> 640 x 480

Daylight
from
upper
right side



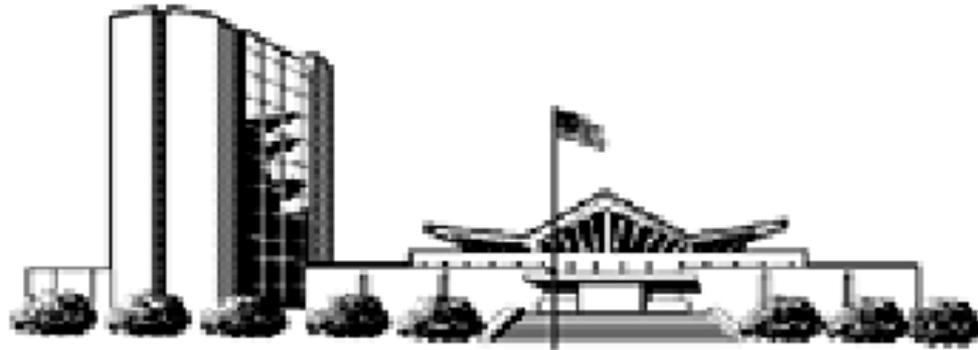
Camera digital zoom: 640 x 480

Halogen
Light
from
above



The only way to predict the future
is to invent it.

*Lister Hill Center National Center for
Biomedical Communications*



Questions and Comments?

<http://pir.nlm.nih.gov>

