ORS Image Project
Report
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Problem: Automate re-naming, re-sizing and path tracing (around region of interest) tasks on images.

Situation

- ORS Nasco has an image processing requirement
  1. Optimizing image size
  2. Pathing the image so as to remove the background
  3. Rename the image based on pre defined rules
- This image processing activity will enable them to re use the images against any background for future promotional/content enhancements
- The above activities are typically done manually through Photo shop and requires an experienced photoshop designer

Complications

- Most of the image processing techniques are approximate

Key Questions

- Is there an algorithmic approach to process images at scale?

End State

- Large scale re usable system that can perform image processing activities like pathing and optimizing image size at an acceptable level of accuracy

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Path tracing

- Path tracing is the process of extracting interested region in an image.

- It is done manually using Adobe Photoshop tools like Magic Wand, Pen tool, Bezier Tool etc.

- Path tracing helps to extract the product image without any background such that clients can place it on their background of interest.

- Amount of time taken to do it manually depends on the complexity of image.

- Time taken to trace path manually ranges from 20 to 40 minutes.

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Path tracing

Automation of Path Tracing Task

Approach	Challenges	Result
• Edge detection algorithm.	• Gradients are detected inside the region of interest.	• Inaccurate results. Image segmentation is not perfect.
• Contour tracing algorithm.	• Contours for images aren't detected sharply. • Also, for light coloured images, tracing is imperfect.	• Contours around light coloured images intersect the inner parts of image. • Not a feasible solution. Variations in images led to other errors.
• Grab-Cut Algorithm	• Far better compared to other approaches. Not perfectly accurate. • Incorrect classification of foreground and background pixels in some images, white pixel noise in complex images.	• Able to classify the foreground and background pixels accurately for most of the images. • White pixel noise for complex images. • Inaccurate classification of fore and back ground pixels for some images.

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Path tracing

Manual VS Automation

- Manual path tracing with Adobe Photoshop gives accurate results.
- It would be tedious to do it for a large number of images.
- Time taken for manual path tracing depend on complexity of the images. Average time taken will be between 20 to 40 minutes.
- In case of automation, time taken will be less than 50 seconds.

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Automation of Re-Sizing Task

Approach

- cv2.resize() function of OpenCV can do it.

Challenges

- Cannot figure out the optimal size of an image automatically.

Result

- Automation is done by fixing standard height of image.

- Aspect ratio of image is maintained to prevent image skewing or distortion.

Manual VS Automation

- Optimal size can be figured out easily by triall and error method if done manually.
- For large number of images, re-sizing becomes tedious.
- Automation can do re-sizing task of large number of images within seconds if width or height of optimal size is known

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Automation of Re-Naming Task

Approach

- Excel sheet read/write libraries like pyxcel_ods(Ubuntu) and xlsxwriter(Windows) are used to get product numbers.

- Images are re-named based on these product numbers stored in python's dictionary

Challenges

- None

Results

- Successfully re-named.

Manual VS Automation

- Re-naming is a tedious task to be done manually.
- Person need to look the excel sheet to find out product numbers and then manually re-name them.
- Automation does it within seconds even for a large excel sheet without any error.

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Accurate example – Machine generated path

Accurate examples – Machine Generated Path

Inaccurate examples – Machine Generated Path

Complex images (In accurate) – Machine Generated Path

Statistics (On Sample Images) :

- Total Images   =   101

- Total Time Taken   =   5000 seconds-Approximate(83.3 minutes)

- Accuracy   =   54.44%

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Detailed Explanation Of Project
&
Bibliography

Problem Statement

- Client (ORS Nasco) expects us to re-name and create a path around the images. (products of Gatorade and Kimberly Clark)

- Both re-naming and path tracing can be done manually.

- <u>Re-naming:</u> Look for product numbers in an excel file and re-name manually which is a tedious task.

- <u>Path-tracing</u>: Can be done manually using Adobe Photoshop software. It requires trained Photoshop designers to accomplish the task accurately.

- ***Aim: To automate these tasks which can save a lot of money, time and human resource.***

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Task1 : Re-naming

- Re-naming is done automatically with the help of python library **pyexcel_ods (Ubuntu). XlsxWriter for Windows machines.**

- Data from excel sheet is read into python's dictionary.

- Product names are mapped to product numbers using this dictionary.

- These product numbers are given as names to images while writing them into folder using **Open-CV imwrite()** function.

- Automating re-naming task drastically reduces the time.

- Re-naming task gets done in seconds, for which manual operator probably take hours.

Task2 : Path Tracing

- Automating path tracing is quite complex.

- Initially, I've tried various image processing techniques such as **edge detection, contours** etc. Accuracy is very low.

- Then I figured Path tracing to be similar to image segmentation problem of image processing.

- Here, image segmentation is between foreground and background pixels. Effective foreground extraction is the final objective.

- I used **Grab-Cut algorithm** which is based on Graph-Cut (a famous image segmentation algorithm) to do it.

- I implemented it using Open-CV and other python libraries mentioned in dependencies slide.

- Although it is not perfectly accurate decent results are obtained.

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Complications

- Some images gave inaccurate results.

- White pixel noise is found around some complex images.

- For some images, internal parts are made transparent.

- Some images are affected by very light noise(small white dots which can be seen only when zoomed).

- Graph-Cut is an approximate algorithm that reasons for complications.

- Research is going on to improve the Grab-Cut algorithm. A lot of developments are made to it. But the image originality is lost. As the complexity of the algorithm is increasing, the image quality goes down. Retaining both is a very difficult task.

- ***Developing it further requires core research.***

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Conclusion

- Although path tracing is not perfectly accurate, I was able to obtain an accuracy of around 54% for 100 sample images. (Assuming the algorithm is ran perfectly with best bounding rectangle – {E-Values – *Please refer Guide.pdf*})

- Obtaining high accuracy by retaining the image quality is highly difficult with the present state of research in the fields of Computer Vision and Image Processing.

- Accuracy can be increased in future through research oriented approaches.

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Dependencies

- **Python 2.7**

- **Open-CV 3.0**

- **PIP**   (To install python libraries)

- **Python Libraries**: Numpy, Operator, PIL, Image, OS, JSON, Time, Ast, Matplotlib, PyExcel_ods(Ubuntu), XlsxWriter(Windows).
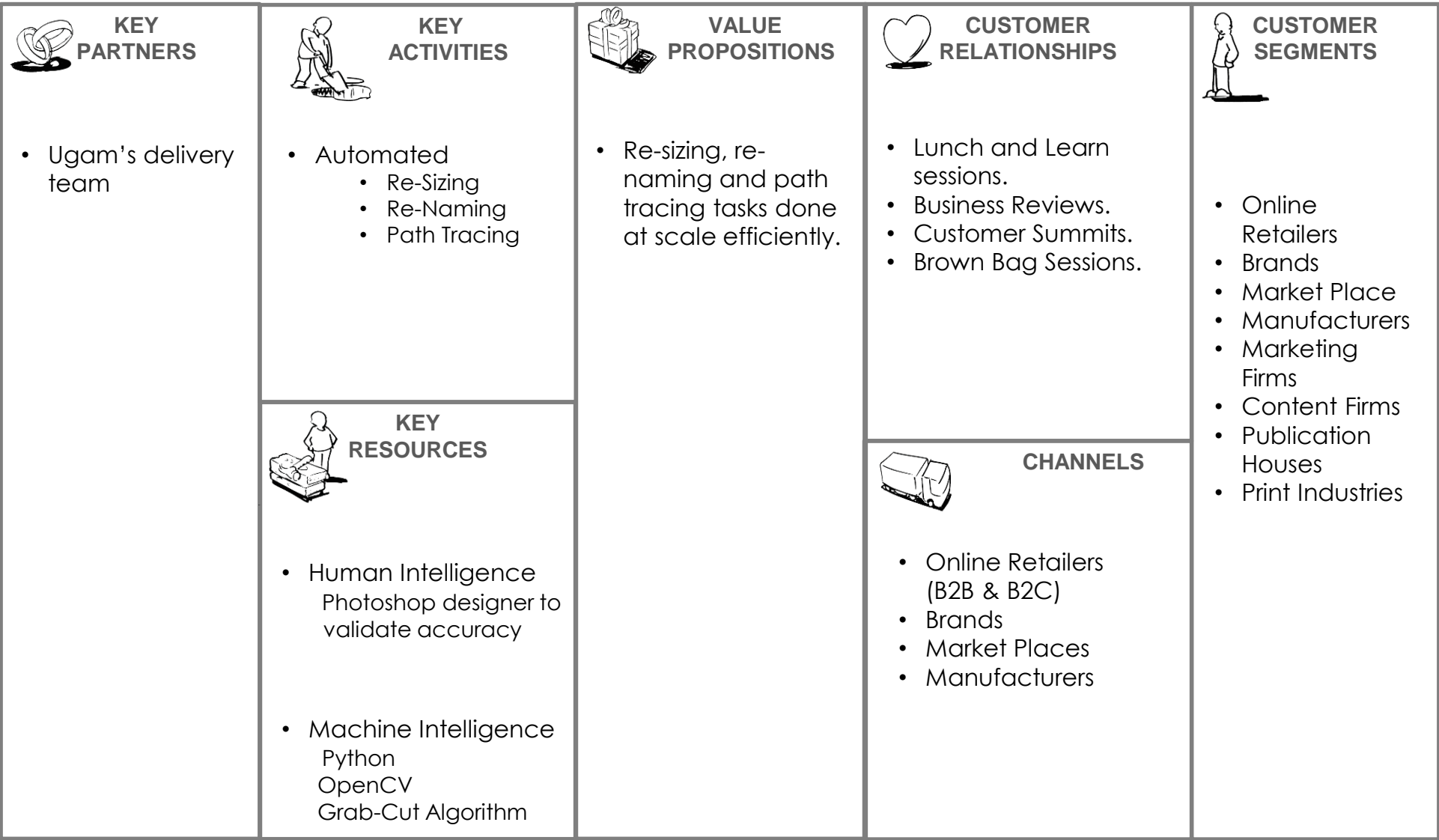
- *Python libraries can be installed simply using pip.*

Bibliography

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- http://docs.opencv.org/3.0-beta/doc/py_tutorials/py_tutorials.html

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- https://docs.python.org/2/index.html

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- https://cvg.ethz.ch/teaching/cvl/2012/grabcut-siggraph04.pdf

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- www.mdpi.com/2073-8994/8/7/64/pdf

- Image processing blogs (To learn various image segmenting techniques)

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- https://blogs.msdn.microsoft.com/rserver/tag/image-segmentation/

- http://bitsearch.blogspot.in/2014/03/understanding-grabcut-interactive.html

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- Other links :-

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- http://answers.opencv.org/question/87261/extract-parts-from-image/

- http://opencv-help.blogspot.in/2013/02/how-to-extract-subimage-from-image-in.html

- Wiki page of Graph-Cut (Good source to learn Grap-Cuts in Computer Vision)

- https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjwmNGNuO_UAhWLp48KHfVCA3UQFgglMAA&url=https%3A%2F%2Fen.wikipedia.org%2Fwiki%2FGraph_cuts_in_computer_vision&usg=AFQjCNFpXvC9GKY0r3mEQcx9Ze8lLgQ1zg

- Open-CV link to Grab-Cut (Useful for implementation)

- http://docs.opencv.org/3.1.0/d8/d83/tutorial_py_grabcut.html

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Value Proposition Model

KEY PARTNERS	KEY ACTIVITIES	VALUE PROPOSITIONS	CUSTOMER RELATIONSHIPS	CUSTOMER SEGMENTS

• Ugam's delivery team	• Automated
	  • Re-Sizing
	  • Re-Naming
	  • Path Tracing
		• Re-sizing, re-naming and path tracing tasks done at scale efficiently.	• Lunch and Learn sessions.
			• Business Reviews.
			• Customer Summits.
			• Brown Bag Sessions.
				• Online Retailers
				• Brands
				• Market Place
				• Manufacturers
				• Marketing Firms
				• Content Firms
				• Publication Houses
				• Print Industries

KEY RESOURCES

• Human Intelligence
  Photoshop designer to validate accuracy

• Machine Intelligence
  Python
  OpenCV
  Grab-Cut Algorithm

CHANNELS

• Online Retailers (B2B & B2C)
• Brands
• Market Places
• Manufacturers

Thank you!

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