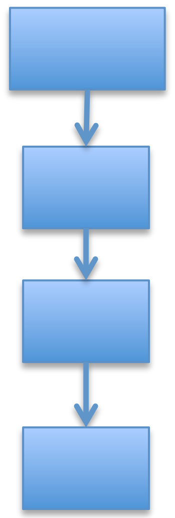
JT Batch Projects

PAR/NIST Cooperative

Eric Robertson

Adhoc Batch Tool

- Works in three modes:
  1. Start with initial images -> create projects
  2. Start with projects -> run plugin on last image found in each project
  3. Start with projects and images with same name as project -> connect image to last image of each project labeling with given operation information
- Dis-advantages?
  1. Produces single line of manipulations projects, thus it cannot support Paste Splice.
  2. Need to run all projects in collective stages, rather start and finish one project at a time.
- Advantages?
  1. Alleviates need to craft a project descriptor.
  2. Does not introduce randomness to image selection.
  3. Can extend existing projects

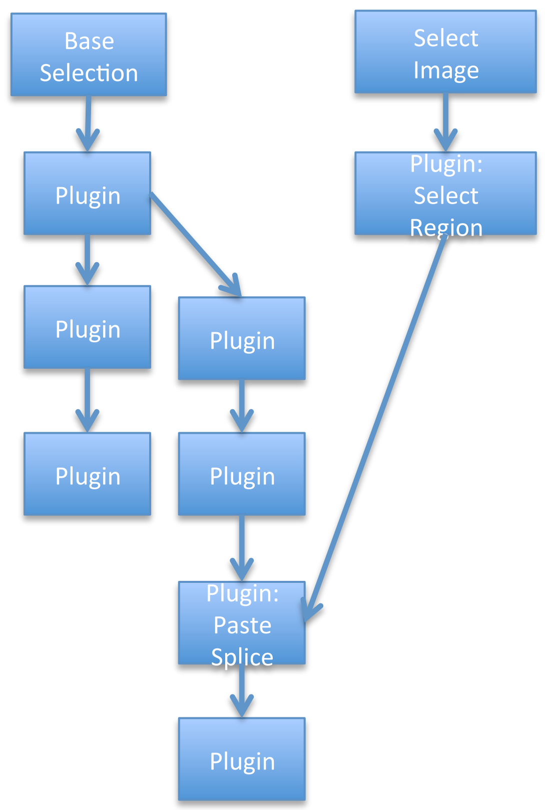


Batch Projects

- Unlike the Adhoc Batch Tool, Batch Projects creates a complete projects from start to finish.
- Batch Projects performs all manipulations with plugins.
- Batch Projects selects images from a pool of images (without replacement).
- The Batch Project graph mirror the final JT projects. What’s the difference?
  - A Node is a plugin (operation)
  - A link is a dependency, defines order of operation.

Batch JT

Process Graph



Operation Nodes:

Select Image: Provided a pool (directory) of images

Base Selection: Same as Select Image, except start new project using the selected image name.

Plugin: Execute a plugin operation to create a new manipulated image. *Requires consistent parameters.*

Input Mask Plugin: Execute a plugin on a image to produce an (input) mask and any additional name/value pairs to be used to as parameters in subsequent operations. Input masks highlight groups of pixels (full intensity) as constraints to other plugins.

Operation Parameters :

- Includes donor images, fixed values, masks, etc.

Links (edges):

- Form the dependency tree and order operation execution.

Each produced journal graph reflects the same structure as the process graph.

JSON

SHELL

```
{
 "directed": true,
 "graph": {
  "username": "ericrobertson",
  "name": "sample",
  "organization": "PAR"
  ”recompress” : true
 },
 "nodes": [ ],
 "links": [  ],
 "multigraph": false
}
```

Name should be unique

Re-apply JPEG or TIFF compression, given base image meta-data, to all final image nodes

List of nodes

List of dependency edges

Node

```
{
 "op_type": "BaseSelection",
 "image_directory": "tests/images",
 "picklist": "imageset",
 "id": "0"
},
```

One of several possible operations

Operation specific parameters

If should match the position of the node in the node list for consistency and clarity

Link

```
{
  "source": 0,
   "target": 2
 },
```

Identification of source and target nodes, in the order they appear in the ‘nodes’ list.

Operations

- **BaseSelection**

  Select an image from a pool of images maintained in a directory. The base selection provides a single image used to start a new project. The selected image provides the name of the project. The image is expected to serve as a (the) base image for the project that is to be manipulated. There must be one and only one BaseSelection node; it must not have any predecessor nodes.

  Parameters:

  - **"image_directory”** = a directory of a pool of images to select from (randomly)
  - **"picklist"**: an in memory structure tracking the names of image files already picked from projects to prevent future selection. A file is created with the same name in the ‘working directory’, retaining the pick list selection across multiple independent and sequential batch runs.

- **ImageSelection**

  Select an image from a pool of images maintained in a directory. Like BaseSelection, an ImageSelection node most not have any predecessor nodes. Unlike BaseSelection, multiple ImageSelection nodes are permitted.

  Parameters:

  The parameters are the same as the BaseSelection. The image directory and picklist can use the same pool as other ImageSelection and BaseSelection nodes.

Operations

- **PluginOperation**

  Invoke a plugin

  - Produce a manipulated target image given a source image.

  Parameters:

  - **“plugin” =** the name of the plugin
  - **“arguments” =** the set of arguments to be provided to the plugin. Each argument as a type and supporting descriptions. <u>Arguments fill **both** the requirements of the plugin and the requirements of the operation definition</u>.

- **InputMaskPluginOperation**

  Invoke a plugin

  - Produce an input mask and any additional name/value pairs based on the source image.

  Parameters:

  - **“plugin” =** the name of the plugin
  - **“arguments” =** the set of arguments to be provided to the plugin. Each argument as a type and supporting descriptions. <u>Arguments fill **both** the requirements of the plugin and the requirements of the operation definition</u>.

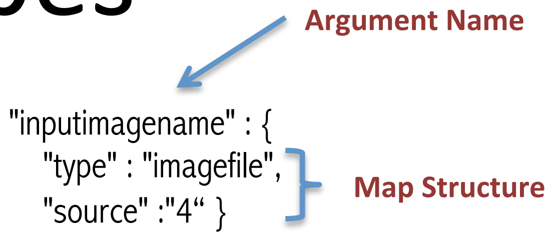
Plugin Review

- Plugins are operations.
- Plugins are provided:
  - Filename of source image
  - Filename of target image
  - Additional arguments
- Plugins action:
  - Overwrite target image
  - Optionally return name/value pairs that may be used as to set parameters of subsequent plugins.
- What is special about the input mask plugin?
  - Given a source image, pre-selects a group of pixels for alteration but subsequent operations.

Sample Plugins

Name	Description	Additional Parameters
SelectRegion	Select a region from a source image. Add an alpha channel, setting the unselected pixels to 0.	
PasteSplice	Place a selected region in a source image. Try to paste in area with the least amount of variance. Resize and rotate the selected region as necessary to fit into the selected area.	"Donor" image
SaveAsPNG	Save source image as a PNG. If the source image has EXIF metadata that contains Orientation and the parameter 'Image Rotated' is yes, rotate the image.	"Image Rotated"
GaussianBlur	Blur the entire image or a selected region of the image, given an optional input mask.	"kernelsize" is a tuple (x,y). The default value is (5,5). "inputmaskname" is the name of a monochrome image file where black pixels indicate the region to blur. The default is blur the entire image

Argument Types



```
"inputimagename" : {
   "type" : "imagefile",
   "source" :"4“ }
```

Each argument is a map containing a set of properties including a type.

- **imagefile = select an image produced by another node. The source node is provided using it's node id.**

```
{
   "type" : "imagefile",
     "source" :"4"
}
```

- **mask= select an image mask produced by another node. Diff masks are specific to an edge: a source and target node pair. An edge is identified by source and target node ids. The mask is used by some plugins to identify areas to adjust.**

```
 {
  "type" : “mask",
  "source" :"4"
  “target" :“6“
}
```

- **value=provide a specific value**

```
"Image Rotated" : {
  "type" : "value",
  "value" :"yes"
}
```

- **donor=pick resulting image from a predecessor node. 'source' is optional.**

```
”input" : {
  "type" : ”donor",
  “source”:”3”
}
```

- **list=pick from a set of values**

```
”subject" : {
  "type" : ”list",
  "values" :[”other”, “landscape”]
}
```

Argument Types Cont.

- **variable = select an output name/value pair from a predecessor plugin node. The source node is provided using it's node id. The pair's value is identified by the name**

```
“box_to_alter “: {
     "type" : “variable",
     “name" : “box_altered“,
       "source" :"4"
 }
```

- **input= identifies the name of input image file (input mask) from the output (target) image of another plugin.**

```
 “inputmask“ : {
    "type" : “input",
    “source" :“6“
 }
```

- **plugin=call a plugin function registered through the Python setuptool's entry point *maskgen_specs*. The function name is the entry point name. The function accepts a dictionary of parameters, provided in the definition.**

```
”kernel" : {
  "type" : ”plugin”,
 “name" : “kernel_builder“,
  ”parameters" : { “kernel_size”: 5}
```

- **Int[low:high]=pick a value, uniform distribution over the range, inclusive.**

```
”kernal_size" : {
  "type" : ”int[1:100]”
}
```

- **float[low:high]=pick a value, gaussian distribution over the range, inclusive**

```
”percent_change" : {
  "type" : ”float[0.0:1.0]”
}
```

- **yesyno=pick yes or no**

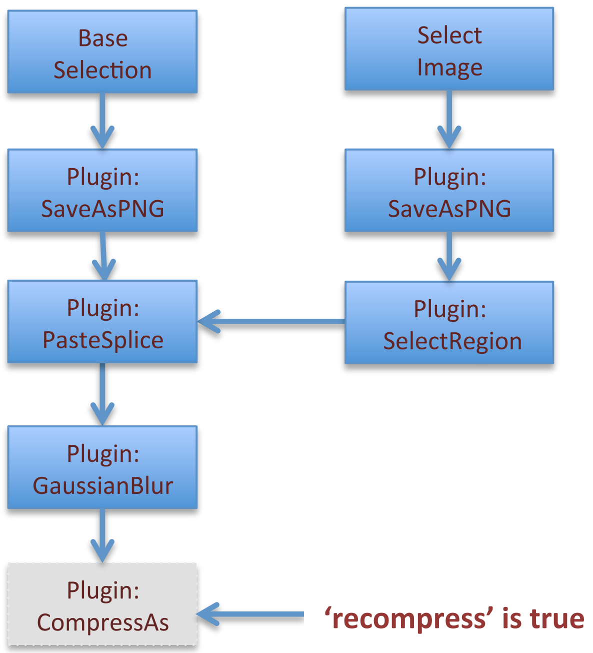
```
”color_correct" : {
  "type" : ”yesno”
}
```

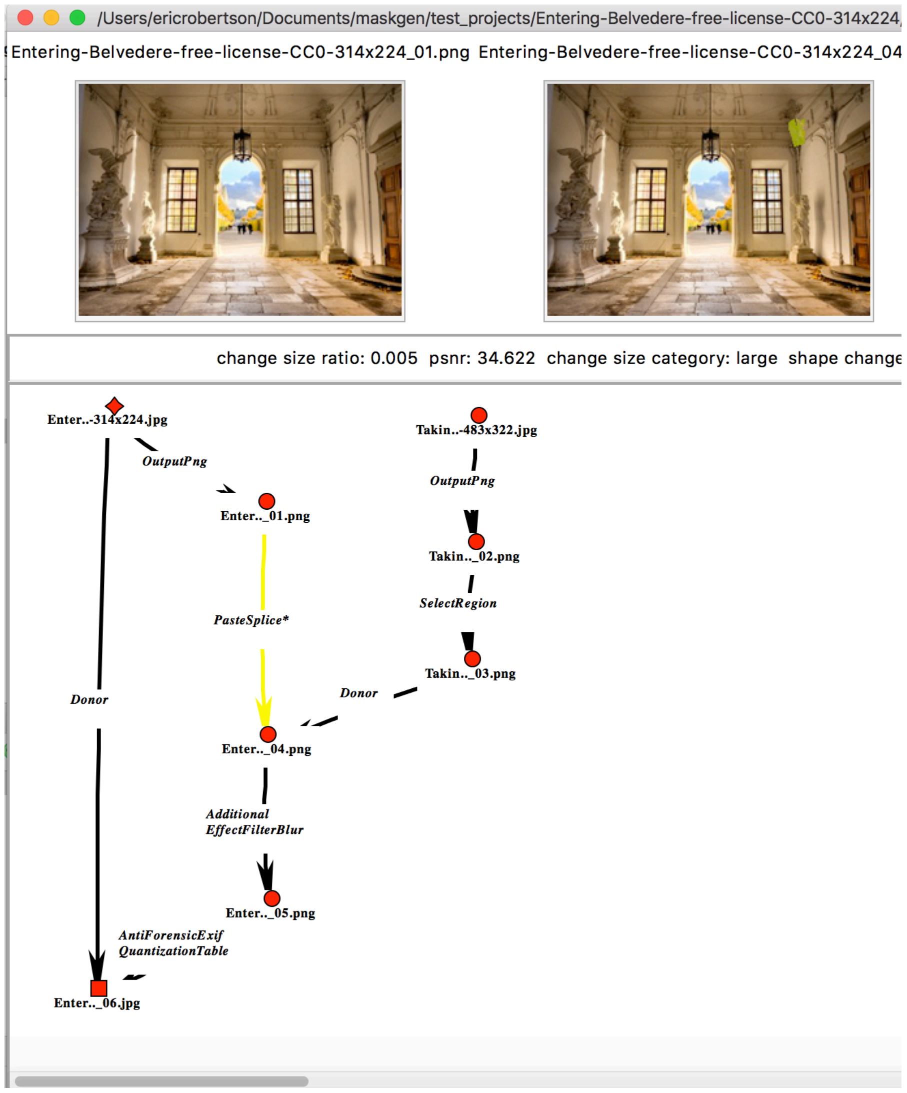
Example JSON

```
{
 "directed": true,
 "graph": {
  "username": "ericrobertson",
  "name": "sample",
  "organization": "PAR"
 },
 "nodes": [
  {
   "op_type": "BaseSelection",
   "image_directory": "tests/images",
   "picklist": "imageset",
   "id": "0"
  },
  {
   "op_type": "ImageSelection",
   "image_directory": "tests/images",
   "picklist": "imageset",
   "id": "1"
  },
  {
   "op_type": "PluginOperation",
   "plugin": "SaveAsPNG",
   "picklist": "imageset",
   "id": "2",
   "arguments": {
    "Image Rotated" : {
     "type" : "value",
     "value" :"yes"
    }
   }
  },
  {
   "op_type": "PluginOperation",
   "plugin": "SaveAsPNG",
   "picklist": "imageset",
   "id": "3",
   "arguments": {
    "Image Rotated" : {
     "type" : "value",
     "value" :"yes"
    }
   }
  },
  {
   "op_type": "PluginOperation",
   "plugin": "SelectRegion",
   "id": "4",
   "arguments": {}
  },
  {
   "op_type": "PluginOperation",
   "plugin": "PasteSplice",
   "id": "5",
   "arguments": {
    ”donor" : {
     "type" : ”donor",
    }
   }
  },
  {
   "op_type": "PluginOperation",
   "plugin": "GaussianBlur",
   "id": "6",
   "arguments": {
    "inputmaskname" : {
     "type" : "mask",
     "source" :"2",
     "target": "5”
    }
   }
  }
 ],
 "links": [
  {
   "source": 0,
   "target": 2
  },
  {
   "source": 1,
   "target": 3
  },
  {
   "source": 3,
   "target": 4
  },
  {
   "source": 2,
   "target": 5
  },
  {
   "source": 4,
   "target": 5
  },
  {
   "source": 5,
   "target": 6
  }
 ],
 "multigraph": false
}
```

Graph View

Process Graph




/Users/ericrobertson/Documents/maskgen/test_projects/Entering-Belvedere-free-license-CC0-314x224

Entering-Belvedere-free-license-CC0-314x224_01.png Entering-Belvedere-free-license-CC0-314x224_04

change size ratio: 0.005 psnr: 34.622 change size category: large shape change

Running

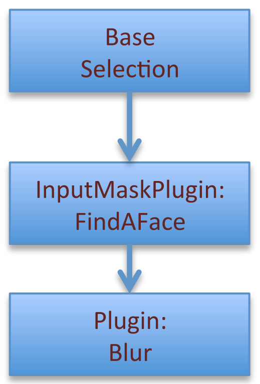
- Install JT
- Make sure the directory to place the created projects exists (e.g. tests/test_projects).
- Example Command Line:

```
Jtproject --count 2 --results tests/test_projects --json tests/batch_process.json --loglevel 0
```

- Arguments
  - Mandatory
    - results = directory to hold completed projects
    - json = the batch process JSON description file
  - Optional
    - count = number of projects to build.
      - Make sure count < number of images in the select image directory
      - By default, just creates one.
      - A value of 0 is used with the 'graph' option.
    - loglevel = 0 to 50 log level, 0 being finest
    - graph = create a Graphviz layout. File name is the name of the batch process + '.png'.
    - threads = number of threads to run, building project in parallel (one thread per project). Default is 1.

Using the InputMaskPlugin

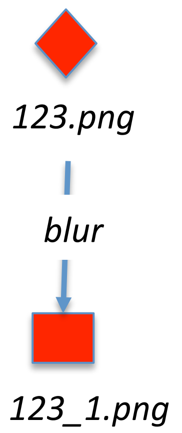
Process Graph



Enable pre-selection of pixels to manipulate by succeeding operation nodes.

In this example, identify regions to blur using a plugin that identifies faces.

Journal Graph



Installing Plugin Functions

Plugin functions are used to set parameters for operations.

Create <u>separate</u> project and install it with the user-defined function. The key piece is the following in setup.py:

```
    entry_points=
            {'maskgen_specs': [
                 ’foo = myplugin.foo:getLength'
             ]
            },
```

Install the project (*python setup.py install*)

The name *foo* is used in as the item name of the plugin type argument specification.
This is a pseudo-name for the function getLength() in the package *myplugin.foo*. The entry point name maskgen_specs is a locator for the JT batch to discover these plug-in specification functions.

Example Operation Node Definition:

```
    "id": "MaskSelect",
    "op_type": "InputMaskPluginOperation",
    "arguments": {
       "percentage_width": {
       "type": "plugin",
       "name" : "foo",
       "parameters" : {"param1" : "whatever"}
      }
```

Paste Splice Options

There are a number of plugins available to aid in Paste Splice. The example project specification tests/batch_process.json under maskgen contains an example paste splice configuration.

In the example, the SelectRegion plugin uses Felzenszwalb to segment the source image to find a spliced object. By default. The PasteSplice plugin places a select image o a random selected area in the target image.

PasteSplice supports a complex placement solution using either SLIC or Felzenszwalb to select a placement region of some uniformity (texture). It includes rescale and rotation as needed, to fit the pasted object into the selected placement region. Naturally, this approach is slower. This option is turned on by setting ‘approach’ to ’texture’ on the PasteSplice plugin (show below).

```
{
 "op_type": "PluginOperation",
 "plugin": "PasteSplice",
 "id": "5",
 "arguments": {
   “approach": {
      "type": "value"
      "value": “texture"
   }
   "donor" : {
     "type": "donor"
   },
                           “approach": {
                              “segment": "value"
                              "value": “felzenszwalb"
                            }
                        }
                     }
```

Options on Paste Splice

The 'approach’ argument is one of 'texture', 'simple', or 'random’. A random selection includes rotation and scaling

Segmentation Algorithms used with the texture approach are set by the ‘segment’ argument. The ‘segment’ argument is one of 'felzenszwalb’ and ’slic’.

Since the transform matrix for the donor mask is calculated, the plugin places the actual transform matrix into the arguments of the PasteSplice edge in the project JSON.   This may be of aid to training algorithms.

SelectRegion plugin

This plugin uses Felzenszwalb to segmented selected image. It does not allow the user to specify the size in pixels of the selected region.

By default, the plugin is assumed to select a region for donation into another image, producing an RGBA image where the alpha channel indicates the select region.

When alpha is set to no, the plugin is used a image selection plugin, saving the result as a mask rather than RGBA image.

```
{
  "op_type": "PluginOperation",
  "arguments": {
             "alpha": {
                  "type": "value",
                  "value": "yes"
                }
  },
  "plugin": “Selection"
},
```

SmartMaskSelector plugin

The SmartMaskSelector uses a SLIC for segmentating of the source image. It allows the user to specify the size in pixels of the selected region.

It supports small, medium and large sizes. The size parameter (1 through 3) randomly selects on of the sizes. The 'op' parameter selects between random box or SLICed segment selector.

The plugin can act in place of the SelectRegion plugin, used prior to a PasteSplice as the tool to select the donor image.

When alpha is set to no <u>or</u> absent, the plugin is used a image selection plugin, saving the result as a mask rather than RGBA image.

```
{
 "op_type": "PluginOperation",
 "arguments": {
  "mediumh": {
   "type": "int[64:128]"
  },
  "smallw": {
   "type": "int[32:64]"
  },
  "largew": {
   "type": "int[128:512]"
  },
  "largeh": {
   "type": "int[128:512]"
  },
  "op": {
   "type": "int[1:2]"
  },
  "smallh": {
   "type": "int[32:64]"
  },
  "size": {
   "type": "int[1:3]"
  },
  "mediumw": {
   "type": "int[64:128]"
  },
  "alpha": {
   "type": "value",
   "value": "yes"
  }
 },
 "plugin": "SmartMaskSelector"
},
```

NOTE: You can force the parameters to a specific value. Suppose you want only small selections with a box shape (without segmentation):

```
{
    "id": "4",
    "op_type": "PluginOperation",
    "arguments": {
...
          "op": {
        "type": "value",
           "value":1
...
          "size": {
              "plugin": "SmartMaskSelector"

  },
```

Pre Segmented Images

Another option for selecting region is the PreSegmentedSelectionRegion plugin.   The plugin is designed to be used with a custom segmentation algorithm, like a deep learning approach. The intent is to have a set of images pre segmented, each with an associated RGB mask image that color codes the regions of the segmented images.

Each output mask has the same name as the image (suffix with .png), and is placed in a separate directory.   Within that same directory, a classification.csv file contains the mappings of color to subject descriptor, in accordance the theSelectRegion journaling categorization (**"people"**,**"face"**,**"natural object"**,**"man-made object"**,**"large man-made object"**,**"landscape"**,**”other”).**

The arguments to the plugin into the segmented mask directory (segmentation_directory) and the color to use (color). The color is optional. In its absence, one will be chosen at random given the available classification colors in the chosen image.

Design Paste Clone

- The DesignPasteClone plugin support paste sampled cloning. It requires in an input mask of the indicated the pixels to be cloned and a location (upper right corner) to paste the cloned region.
- It is used in conjunction with either the SelectionRegion or SmartMaskSelector plugins (alpha) configured as InputMaskPluginOperations as the source of the input mask, paste_x and paste_y argument values.

```
"id": "DesignPasteClone1",
   "op_type": "PluginOperation",
   "arguments": {
    "inputmaskname": {
      "source": "CloneMaskSelect",
      "type": "input",
      "description": "localized selector"
    },
    "paste_y": {
      "source": "CloneMaskSelect",
      "type": "variable",
      "name": "paste_y",
      "description": "localized  y position paste"
    },
"paste_x": {
      "source": "CloneMaskSelect",
      "type": "variable",
      "name": "paste_x",
      "description": "localized x position paste"
     },
     "purpose": {
      "type": "value",
      "value": "clone"
     }
    },
    "experiment_id": null,
    "plugin": "DesignPasteClone"
   },
```