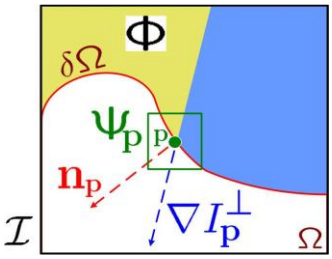
Computer Vision Final Project

- 主題：examplar-based image completion

- 參考文獻：

A. Criminisi, P. Perez, K. Toyama.
Region-flling and object removal by exemplar-based inpainting.
In 2004 IEEE Transactions on Image Processing 9 1200-121

- 演算法：



- Extract the manually selected initial front $\delta\Omega^0$.
- Repeat until done:

1a. Identify the fill front $\delta\Omega^t$. If $\Omega^t = \emptyset$, exit.
1b. Compute priorities $P(\mathbf{p}) \quad \forall \mathbf{p} \in \delta\Omega^t$.
2a. Find the patch $\Psi_{\hat{\mathbf{p}}}$ with the maximum priority, *i.e.*, $\hat{\mathbf{p}} = \arg\max_{\mathbf{p}\in\delta\Omega^t} P(\mathbf{p})$.
2b. Find the exemplar $\Psi_{\hat{\mathbf{q}}} \in \Phi$ that minimizes $d(\Psi_{\hat{\mathbf{p}}}, \Psi_{\hat{\mathbf{q}}})$.
2c. Copy image data from $\Psi_{\hat{\mathbf{q}}}$ to $\Psi_{\hat{\mathbf{p}}}$ $\forall \mathbf{p} \in \Psi_{\hat{\mathbf{p}}} \cap \Omega$.
3. Update $C(\mathbf{p}) \quad \forall \mathbf{p} \in \Psi_{\hat{\mathbf{p}}} \cap \Omega$

$$P(p) = C(p)D(p)$$

$$C(p) = \frac{\sum_{q\in\Psi_p\cap(I-\Omega)} C(q)}{|\Psi_p|}$$

$$D(p) = \frac{|\nabla I_p^{\perp} \cdot n_p|}{\alpha}$$

- 實作：

$\nabla I_p^{\perp}$ in `compute_gradient();` in `init();` using `Scharr();` in OpenCV

n_p in `compute_boudary();`
$C(p)$ in `compute_confidence();`
$D(p)$ in `compute_data();`

1a. `compute_boudary();`
1b.2a. `get_boundaryPixel();`
2b.2c.3. `match_boundaryPixel();`

```
class imageCompletor
{
    void init();
    void compute_gradient();

    void compute_boundary();
    void compute_confidence();
    void compute_data();

    Point2i get_boundaryPixel();
    void match_boundaryPixel(Point2i px);

    bool isCompleted();

public:

    Mat complete()
    {
        init();
        while (!isCompleted()) {
            compute_boundary();
            compute_confidence();
            compute_data();
            Point2i nextBoundaryPixel = get_BoundaryPixel();
            match_BoundaryPixel(nextBoundaryPixel);
        }
    }
};
```

- 使用方法：

請輸入 image file name 及 mask file name，如欲手動繪製 mask 請輸入 0。
手動繪製操作：r 重置，space 完成，z 筆刷變小，x 筆刷變大，ESC 結束。

- 實驗結果：詳見 `./data`

input image	input mask	output image