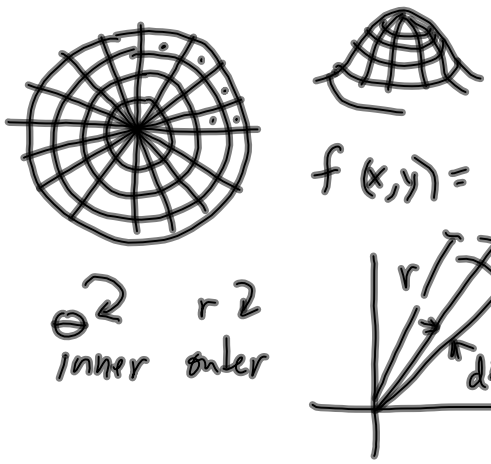
25-1



$f(x,y) =$

θ 2 r 2
inner outer

area of differential element $r\,d\theta\,dr$

volume element $f(x,y) \cdot r\,d\theta\,dr$

Apr 5-10:29 AM

25-2

$\iint_{\text{circle}} f(x,y)\,dx\,dy$ change of variable $\begin{matrix} x \\ y \end{matrix} \to \begin{matrix} r \\ \theta \end{matrix}$

$x = r\cos\theta$
$y = r\sin\theta$,

$$\int_0^{2\pi}\int_0^R f(r\cos\theta, r\sin\theta)\,|J|\,dr\,d\theta$$

$$J = \begin{bmatrix} \partial x/\partial r & \partial x/\partial\theta \\ \partial y/\partial r & \partial y/\partial\theta \end{bmatrix} = \begin{bmatrix} \cos\theta & -r\sin\theta \\ \sin\theta & r\cos\theta \end{bmatrix}$$

$r\cos^2\theta + r\sin^2\theta = r(\underbrace{\cos^2\theta + \sin^2\theta}_{1}) = r$

$$\int_0^{2\pi}\int_0^R f(r\cos\theta, r\sin\theta)\,r\,dr\,d\theta$$

Apr 5-10:30 AM

25-3

$$\sum_{r=0}^{R} \sum_{\theta=0}^{2\pi} f(r\cos\theta, r\sin\theta)\, r \cdot \Delta\theta \cdot \Delta r$$

select P
integrate until we reach P, then return r

CE/LE CE circular error
LE linear error

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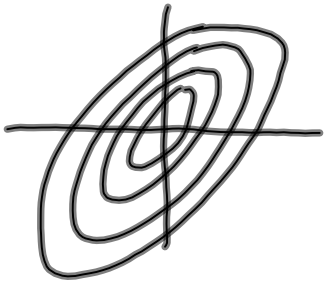
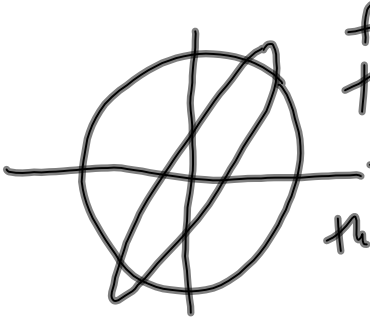
25-4



because symmetric you can integrate from $0 \to \pi$ and mult by 2



for same probability level the error conf circle is always larger than confidence ellipse

that's penalty you pay for simplicity

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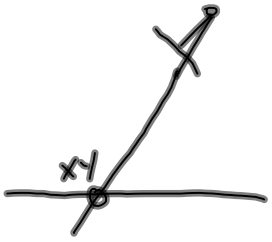
Error Prop. $y = Ax$, Σ_{xx}]
$\Sigma_{yy} = A \Sigma_{xx} A^T$]

25-5



$\begin{pmatrix} x \\ y \end{pmatrix} = f(\omega, \phi, k, X_L, Y_L, Z_L, z, x, y)$

assume $x_0, y_0, f_1, k_1, k_2 \ldots$ constant

$\Sigma_{\begin{pmatrix} x \\ y \end{pmatrix}}$, ~~$J_{xR}$~~

$$J_{xp} = \begin{bmatrix} \partial x/\partial\omega & \partial x/\partial\phi & \partial x/\partial k & \cdots & \partial x/\partial x & \partial x/\partial y \\ \partial y/\partial\omega & \partial y/\partial\phi & \partial y/\partial k & \cdots & \partial y/\partial x & \partial y/\partial y \end{bmatrix}$$

Apr 5-10:30 AM

$\Sigma_{yy} = J_{xp} \Sigma_{pp} J_{xp}^T$

25-6

$$\Sigma_{pp} = \begin{bmatrix} \sigma_\omega^2 & \sigma_{\omega\phi} & \sigma_{\omega k} & \cdots & \cdots \\ & \sigma_\phi^2 & \sigma_{\phi k} & & \\ & & \sigma_k^2 & & \\ & & & \sigma_{X_L}^2 & \\ & & & & \ddots \end{bmatrix}$$

can do error prop. with non linear functions – just replace A with J

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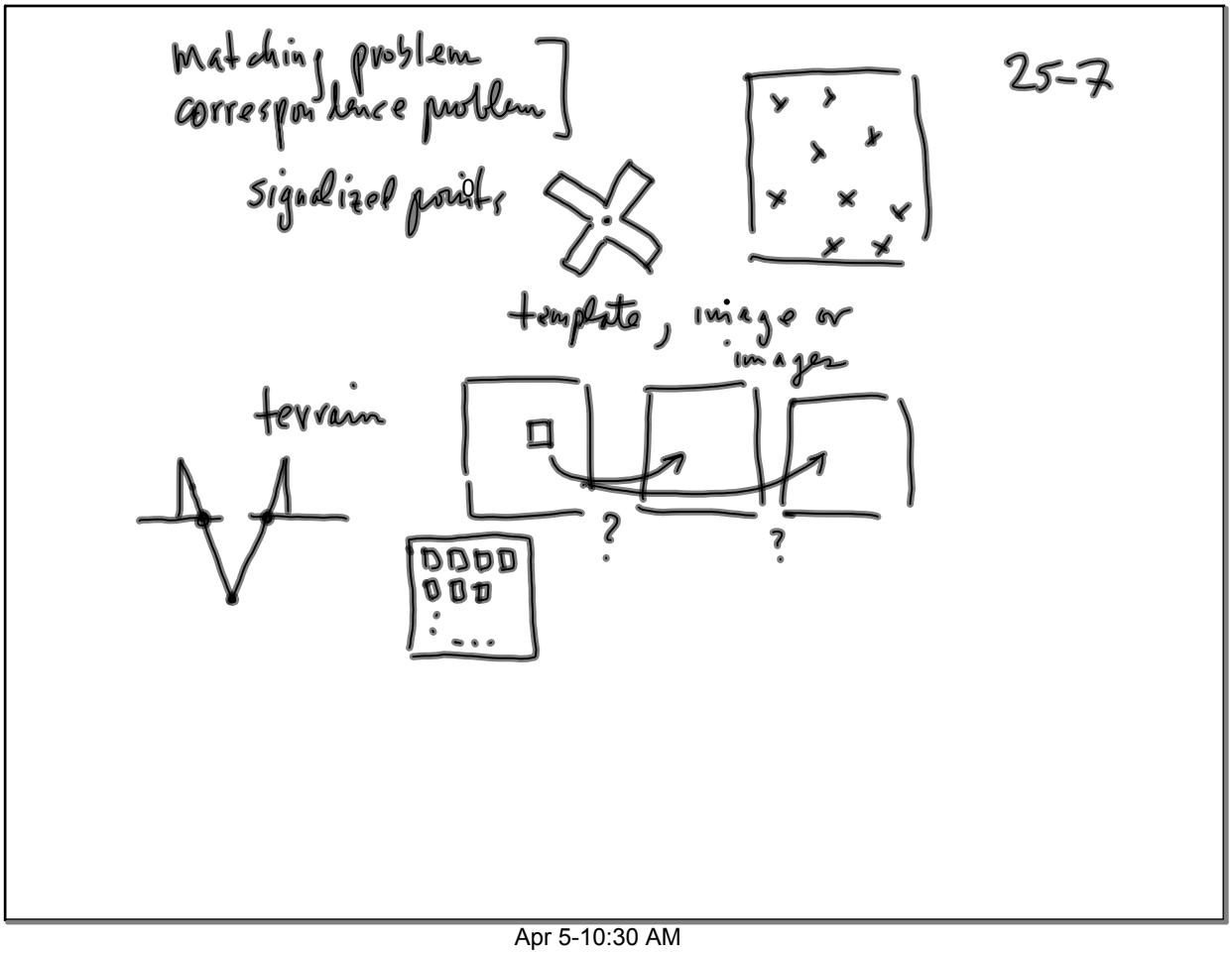

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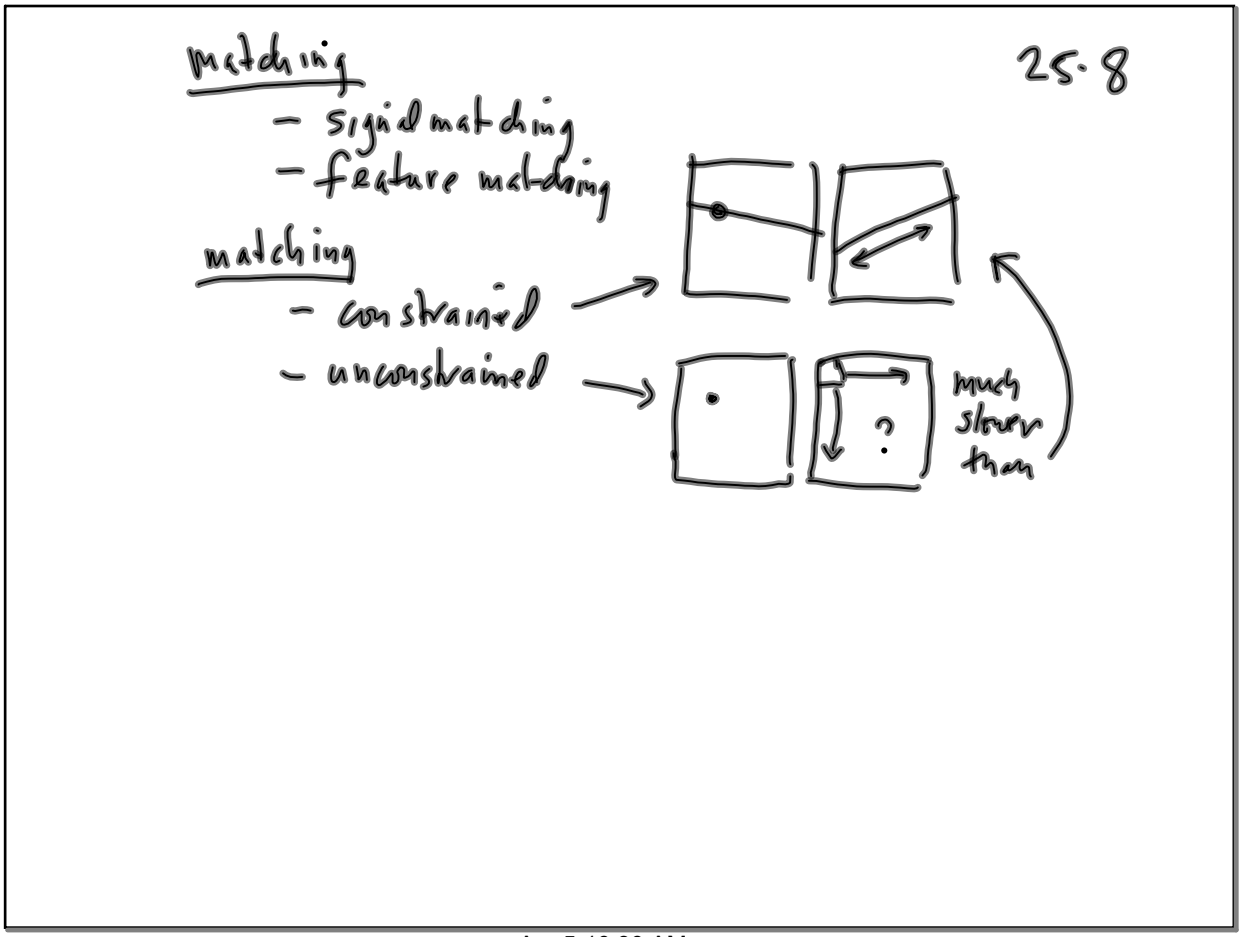

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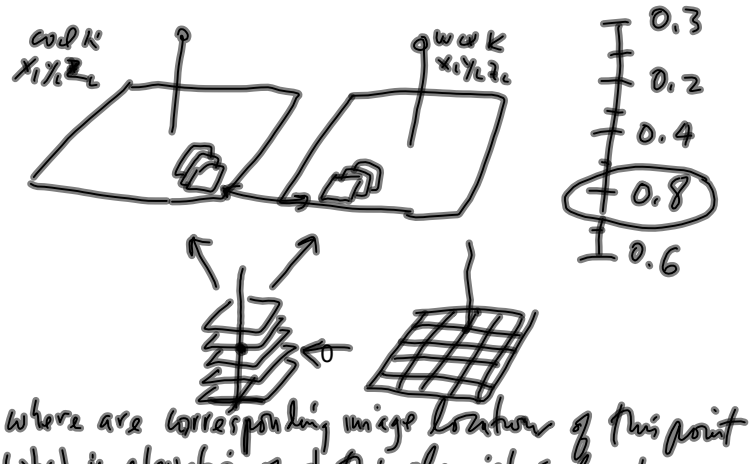
another approach to ~~cost~~ constrained matching 25-9
VLL: Vertical line locus



where are corresponding image location of this point
what is elevation of at this planimetric location

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~~Cross~~ Cross correlation returns value -1 → +1 25-10
§ correlation coefficient, ρ r (sample)
(population)

+1 perfect match
-1 opposite intensity level,
0 unrelated

~~Co~~ Cross correlation → space domain
→ freq. domain

Cross correlation has many uses + applications,
GPS, RADAR

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LSM: least squares matching refinement

25-11

Apr 5-10:30 AM