Lecture 39 - Optimization & Epilogue

Optimization → choice → overdetermined
                              → underdetermined
             → fight against limited resources

↓ Estimation

↓ design parameters

3 regr → System

10 $ax + by + cz = cash$

Engineering problem

Send food to refugees

↓

Given an amount of food to be transported (given)

1) How many packets are optimal? (integer)
2) What is the size of the parachute? (real)

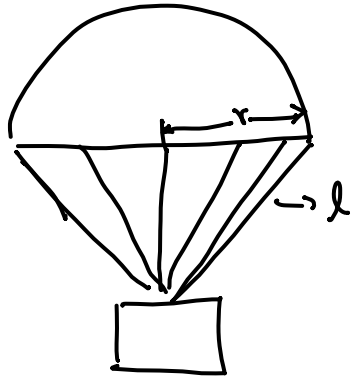
} design parameters

$x \geq 15$
$y \geq 5$

} constraint

Parachute → $v_{terminal} \leq 20 m/s$
cost

} constraints



$A = 2\pi r^2$

$l = \sqrt{r}$

$M \rightarrow [n] = \frac{M}{[m]}$?

drag

$C = k_c A$

$v \leq 20\ m/s$

$n \geq 1$

} constraints

cost

$\Phi = n(\phi_0 + \phi_1 l + \phi_2 A^2)$

optimize

minimize n → speed of delivery
→ reduced cost

linear cost functions

Minimize $\Phi = n(\phi_0 + \phi_1 l + \phi_2 A^2)$ → cost function

↓ differentiation

↓ calculus of variations

subject to

$v \leq v_{terminal}$

$n \geq 1$

} constraints

	Constrained	Unconstrained
linear		
quadratic		
non-linear		

Optimization → Summary

- Cost function → linear / non-linear → minimize / maximize → Calculus of variation
- constraints
- design parameter

Least squares → quadratic cost function

$$\Phi = x^T Q x + c^T x + d \rightarrow$$

↓ positive semi-definite x symmetric matrix

$$\Phi = (y - Ax)^T (y - Ax)$$

$$\Phi = y^T y - y^T A x - x^T A^T y + x^T A^T A x$$