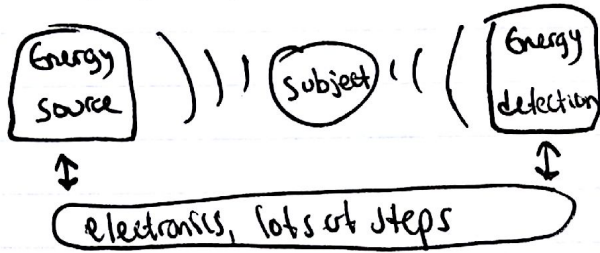


lecture 2 - Intro to Imaging! 19/11/15

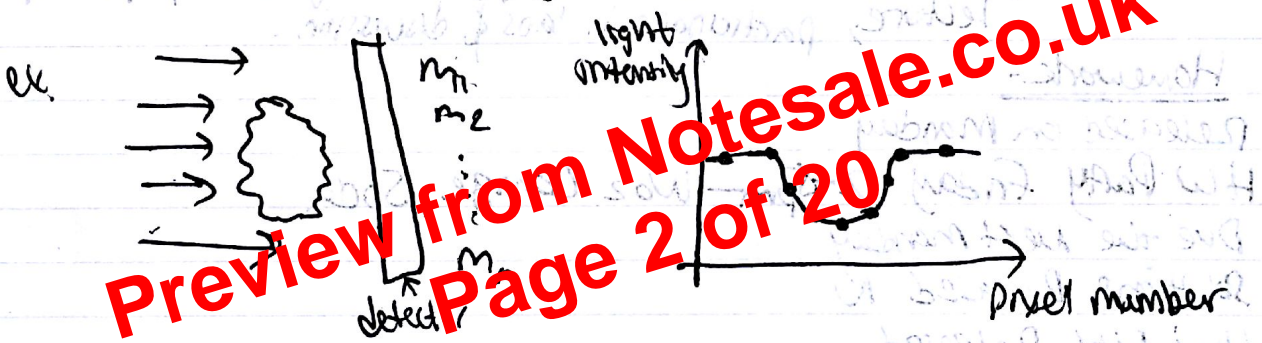
Introduction to Imaging

Medical Imaging ex: x-ray, ct, MRI, Ultrasound
 Imaging in general



Simplest imaging:

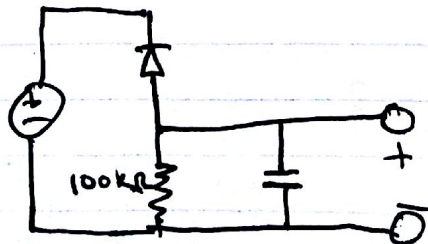
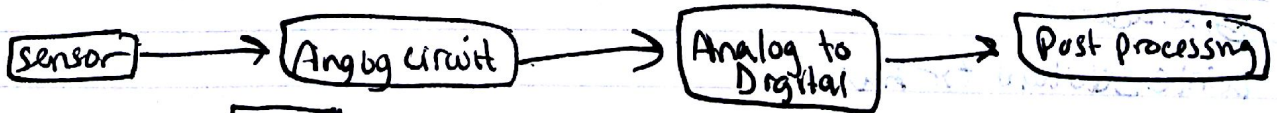
1. moving detector, uniform light
2. uniform detector, moving light



ex. Ultrasound

- sound waves travel into body and an echo signal is recorded. This echo is due to changes in material properties

Imaging Lab #1



Python

vector/matrix versions:

$$\begin{bmatrix} 1 & 1 & 0 & 0 \\ 0 & 0 & 1 & 1 \\ 1 & 0 & 1 & 0 \\ 1 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix} = \begin{bmatrix} 1 \\ 1 \\ 1 \\ 0 \end{bmatrix}$$

summation of unknown observations

learn how to multiply matrices with unknowns

example 2

a	b	c
d	e	f
g	h	i

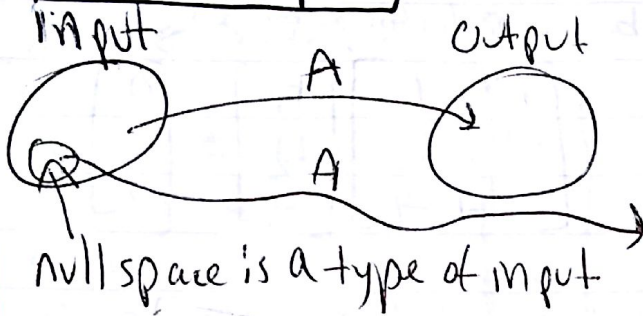


impossible to predict which measurement is redundant

we need linear algebra!

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Lecture: Nullspaces



to find null space set operation = $\langle 0, 0 \rangle$

find nullspace of

$$\begin{pmatrix} 1 & 0 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$x=0$ \leftarrow nullspace is all vectors where $x=0$ such as $\begin{pmatrix} 0 \\ 1 \end{pmatrix}, \begin{pmatrix} 0 \\ 3 \end{pmatrix}, \begin{pmatrix} 0 \\ 100 \end{pmatrix}$ etc.

ex.

$$\begin{pmatrix} 1 & 2 \\ 0 & 0 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0$$

$$x + 2y = 0$$

$$y = -\frac{1}{2}x$$

Rank Nullity Theorem:

of lin independent rows + degree of nullspace = # of columns
(rank(A))

Lecture - Nullspaces, Graphs & Flows, Pagerank

Defn: A basis for a vector space is a 'minimal' set of vectors that span the entire vector space (minimal = numbers in the set is as small as possible)

The dimensionality of a vector space is the number of basis vectors needed.

The rank of a matrix A is the dimensionality of its range(A)
(full rank is maximal rank)

Range(A) = span of columns of A = where can you get to using A (combination of columns of A)

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