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Tutorial - 4

① Independent Component Analysis
Mixing statistically ind. sources

Var. of mixture = $var(x) = \langle (x - \langle x \rangle)^2 \rangle$

$= \langle x^2 \rangle - (\langle x \rangle)^2$

$= \langle (\sum w_i s_i)^2 \rangle - (\langle \sum w_i s_i \rangle)^2$

$= \langle (\sum w_i s_i)(\sum w_j s_j) \rangle$
$- (\sum w_i \langle s_i \rangle)(\sum w_j s_j)$

$= \langle \sum w_i w_j s_i s_j \rangle -$
$\sum w_i w_j \langle s_i \rangle \langle s_j \rangle$

$= \sum w_i w_j (\langle s_i s_j \rangle - \langle s_i \rangle \langle s_j \rangle)$

$+ \sum w_i w_j (\langle s_i s_j \rangle - \langle s_i \rangle \langle s_j \rangle)$

$= \sum w_i^2 (\langle s_i s_j \rangle - \langle s_i \rangle^2)$

$+ \sum w_i w_j (\langle s_i \rangle \langle s_j \rangle - \langle s_i \rangle \langle s_j \rangle)$

s_i & s_j are statistically ind. for $i \neq j$

$\Rightarrow \langle s_i \rangle \langle s_j \rangle - \langle s_i \rangle \langle s_j \rangle = 0$

& $var(s_i) = 1$

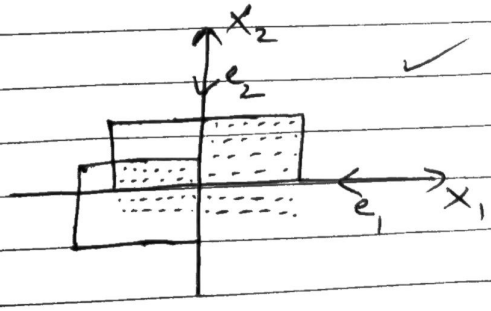
$\therefore var(x) = \sum w_i^2$

to guarantee that mixture has unit var,

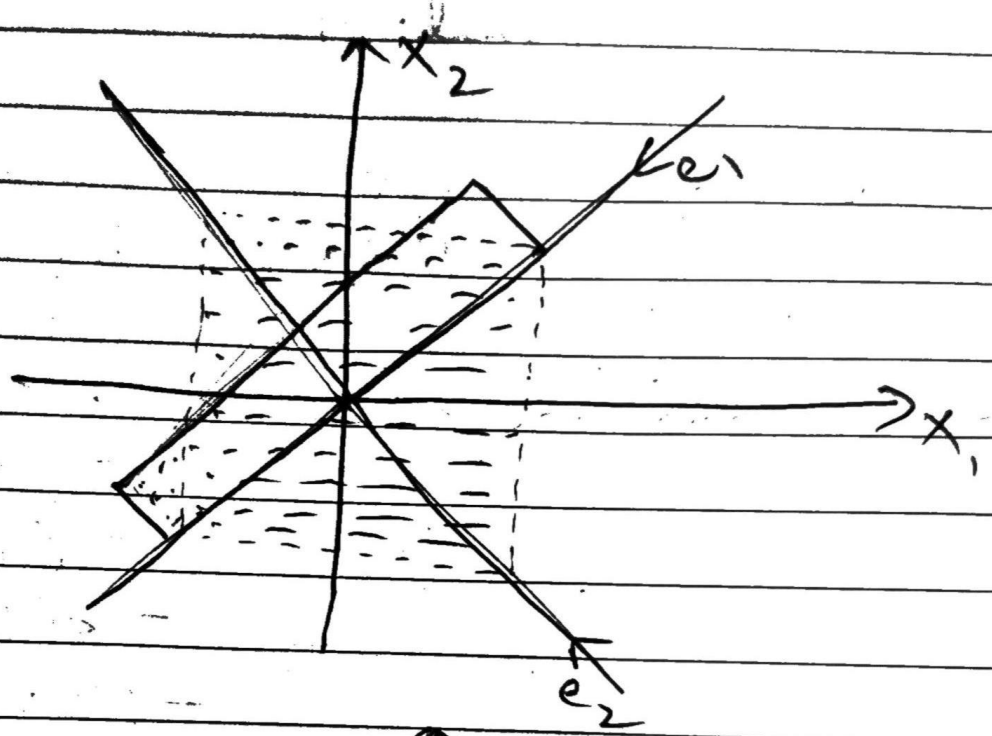
$var(x) = 1$

$\Rightarrow \boxed{\sum w_i^2 = 1}$

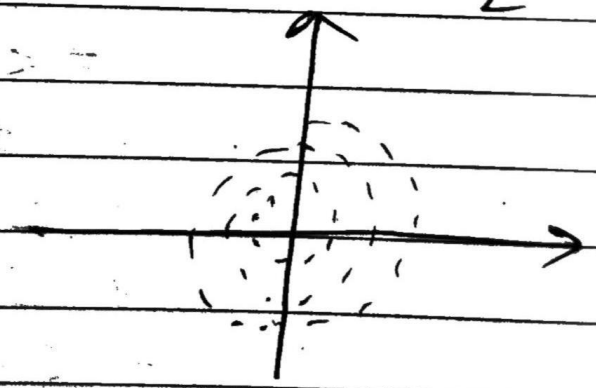
② a)



b)



c)



x can't be separated into ind. components