Subject : Intro. to Info. Theory

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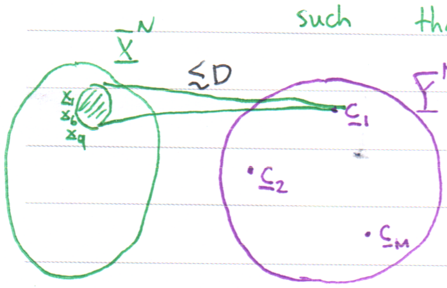
* idea 2 :

get $\boxed{\text{enough}}$ typical $\underline{y}$'s as $\mathbb{C} = \{ \underline{c}_m \}_{m=1}^{M}$

such that every typical $\underline{x}$ is (usually) $\lesssim D$ to some $\underline{c}_m$



recall : $\nu(\underline{x}) = \underline{c}_m : d(\underline{x}, \underline{c}_m)$ smallest

intuition : good $\mathbb{C}$ should "spread" typical $\underline{y}$'s

* a "randomized algorithm" for "constructing" good $\mathbb{C}$

$\mathbb{C}_1 \sim (p(\underline{y}))^M$ "good" (pay $\leq d_q + \frac{\epsilon}{2}$, within T)

$\Updownarrow$

typical $\underline{x}_1$ $\quad (1 - P_{T(\underline{x}_1)}(\underline{y}))^M$ "BAD" (pay $> D + \frac{\epsilon}{2}$)

$$\| $$

$$\sum_{\underline{y} \in T(\underline{x}_1)} p(\underline{y})$$

$$\geq \sum_{\underline{y} \in T(\underline{x}_1)} 2^{-(I + \frac{1}{2}\epsilon)N} \, p(\underline{y} | \underline{x}_1)$$

$\S$ 1 because typical

$$\approx 2^{-(I + \frac{1}{2}\epsilon)N}$$

- $\mathbb{C}_1$ is bad for $\underline{x}_1$ with prob $\lesssim (1 - 2^{-(I + \frac{1}{2}\epsilon)N})^M$

$\mathbb{C}_1$ is bad for $\underline{x}_2$ "

$\mathbb{C}_1$ $\quad \vdots \quad$ "

$\mathbb{C}_1$ $\quad \underline{x}_? \quad$ "

$\mathbb{C}_2$ is bad for $\underline{x}_1$ with prob $\lesssim (\qquad)^M$

$\mathbb{C}_2$ $\quad \vdots$

$\vdots$

$\mathbb{C}_2$

$\vdots$

$\Rightarrow$ $\quad \mathbb{C}_1 \quad \mathbb{C}_2 \quad \mathbb{C}_3 \quad \cdots$

typical
$p(\underline{x}_1)$ $\underline{x}_1$ $\leq (\quad)^M$
$p(\underline{x}_2)$ $\underline{x}_2$ $\leq (\quad)^M$
$p(\underline{x}_3)$ $\underline{x}_3$ $\leq (\quad)^M$
$\vdots$

$\boxed{\underline{x}_{AT}} \leq \delta$

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* when $M = \lfloor 2^{(R+\epsilon)N} \rfloor$ (small VQ rate)

$$(1-\square)^M \leq e^{-M\square}$$ by $e^{M\ln(1-\square)} \leq e^{M(-\square)}$

$$\simeq e^{-2^{(R+\epsilon)N} 2^{-(I+\frac{\epsilon}{2})N}}$$

$$= e^{-2^{\boxplus N}}$$

total BAD $\leq \left(\sum_{\text{typical}} p(x)\, e^{-2^{\boxplus N}} + \boxed{\text{atypical}} \right) d_* \leq \frac{\epsilon}{2}$

GOOD $\leq \bar{d}_q + \frac{\epsilon}{2} \leq D + \frac{\epsilon}{2}$

small VQ distortion for "average $\mathcal{C}_t$"

$\Downarrow$

exists small VQ distortion for "one $\mathcal{C}_t$"