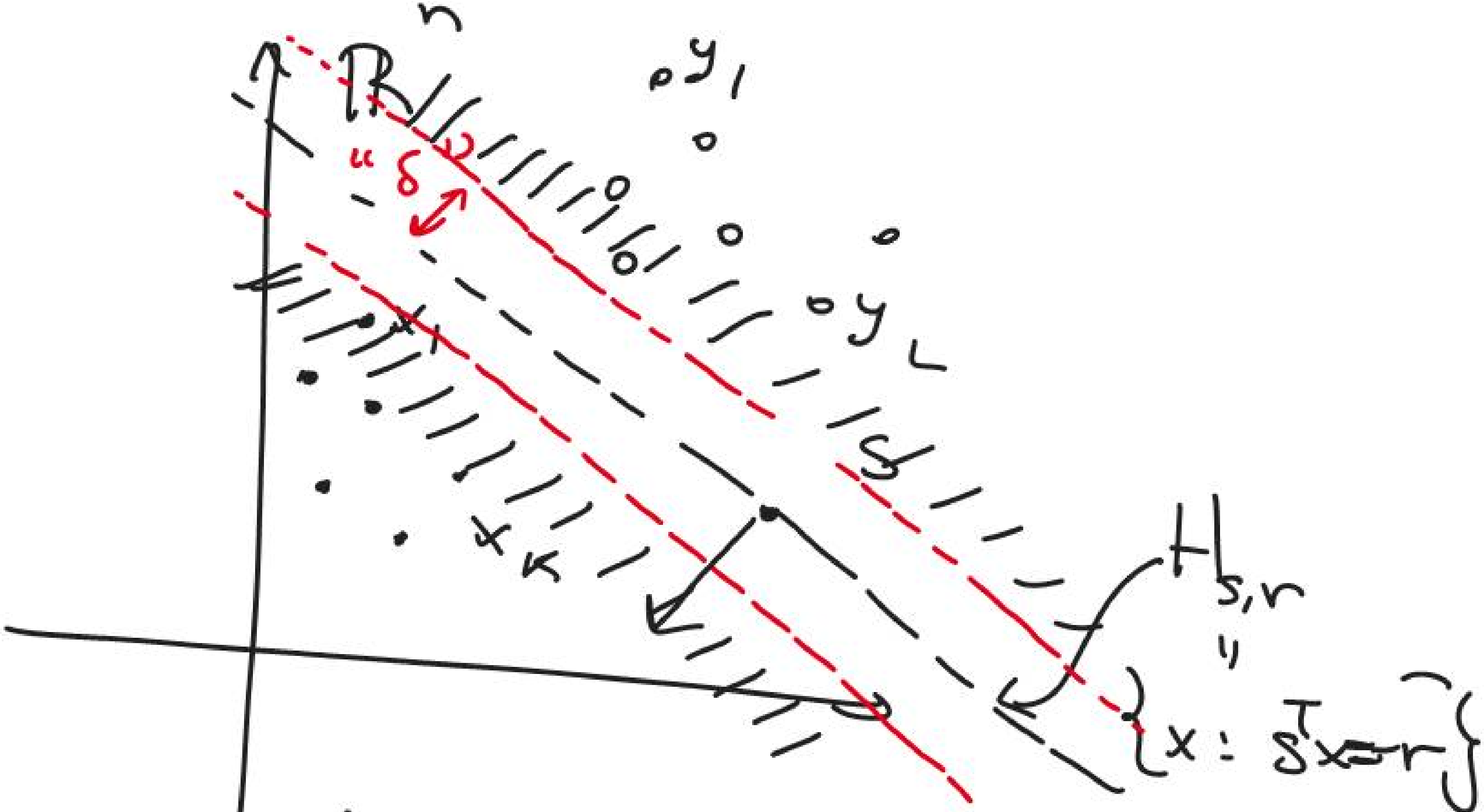
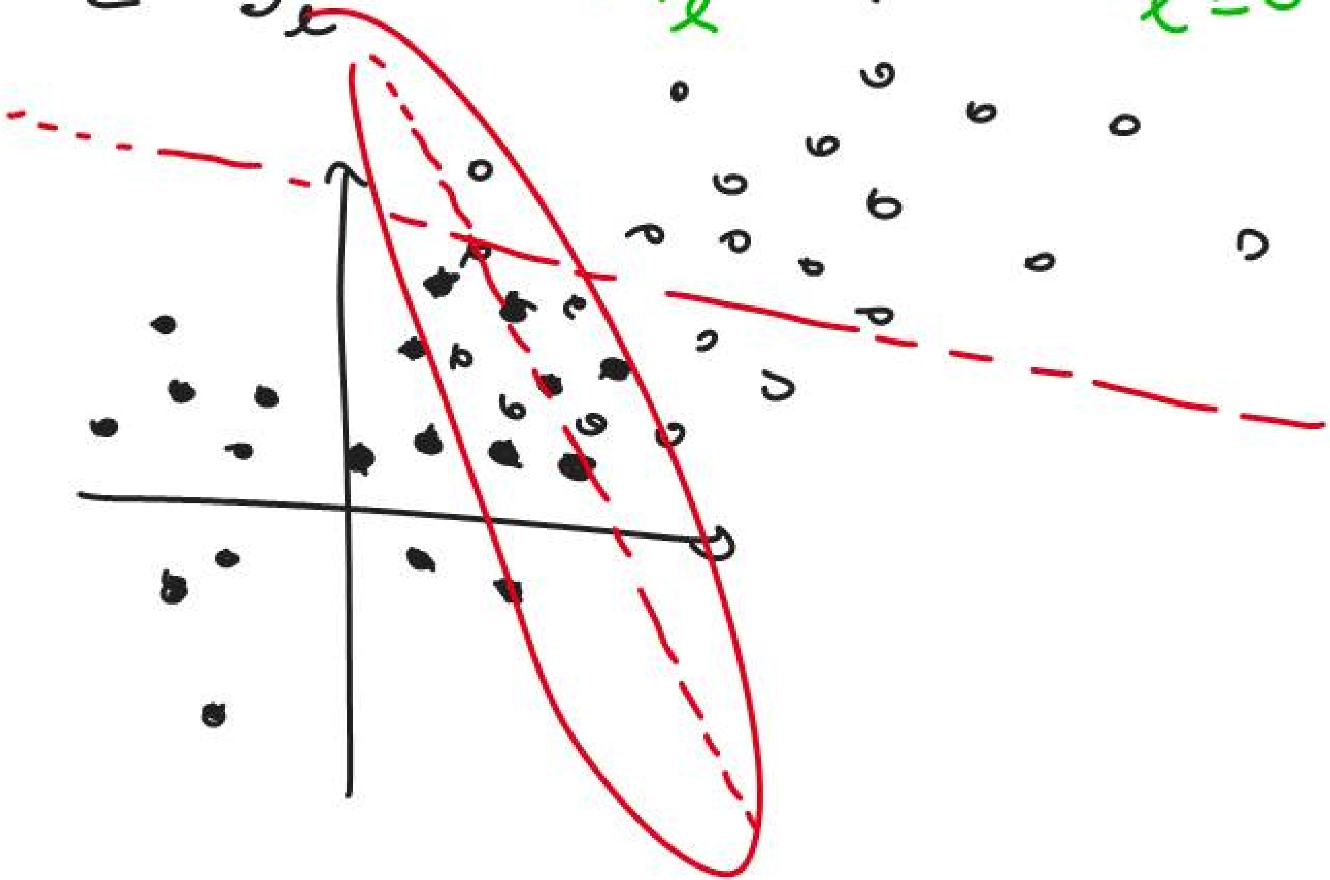
Γ



$$(s, r, \delta) : \begin{cases} s^T x_k \geq r + \delta & \forall\, k = 1, \dots, K \\ s^T y_\ell \leq r - \delta & \forall\, \ell = 1, \dots, L \end{cases}$$

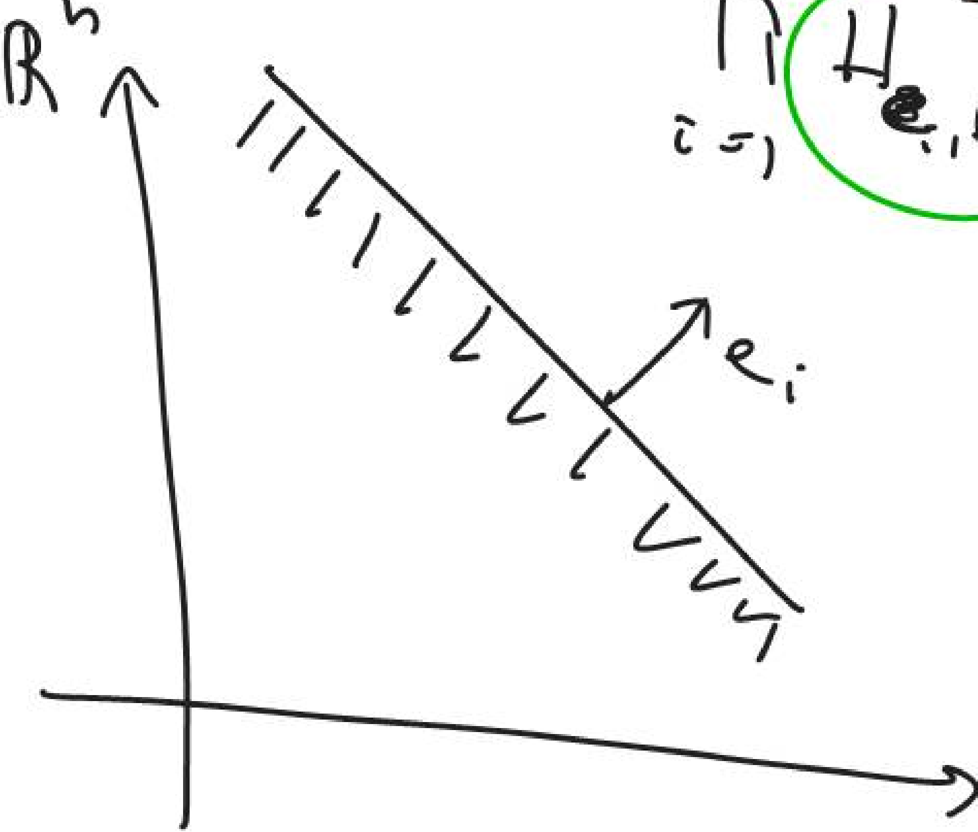
$$\begin{cases} s^T x_k \geq r + 1 - u_k \quad \forall k & u_k \geq 0 \\ s^T y_\ell \leq r - 1 + v_\ell \quad \forall \ell & v_\ell \geq 0 \end{cases}$$



$$\max \quad R$$
$$\text{s.t.} \quad B(c,R) \subset P$$

$E: m \times n$

$$P = \{x : Ex \le f\} = \bigcap_{i=1}^{m} H^{-}_{e_i, f_i} = \bigcap_{i=1}^{m} \{x : e_i^T x \le f_i\}$$



$$E = \begin{bmatrix} e_1^T \\ e_2^T \\ \vdots \\ e_m^T \end{bmatrix} \qquad f = \begin{bmatrix} f_1 \\ f_2 \\ \vdots \\ f_m \end{bmatrix}$$

$$A \subset B_1 \cap B_2 \cap \cdots \cap B_m \qquad a \le \min\{b_1, b_2, \ldots, b_m\}$$

$$\Updownarrow \qquad\qquad \Updownarrow$$

$$\begin{cases} A \subset B_1 \\ A \subset B_2 \\ \vdots \\ A \subset B_m \end{cases} \qquad \begin{cases} a \le b_1 \\ a \le b_2 \\ \vdots \\ a \le b_m \end{cases}$$

$$\max. \quad R$$

$$\text{s.t.} \quad B(c,R) \subset H^{-}_{e_1,f_1} \quad \overset{?}{\Longleftrightarrow} \quad g_1(c,R) \le 0$$

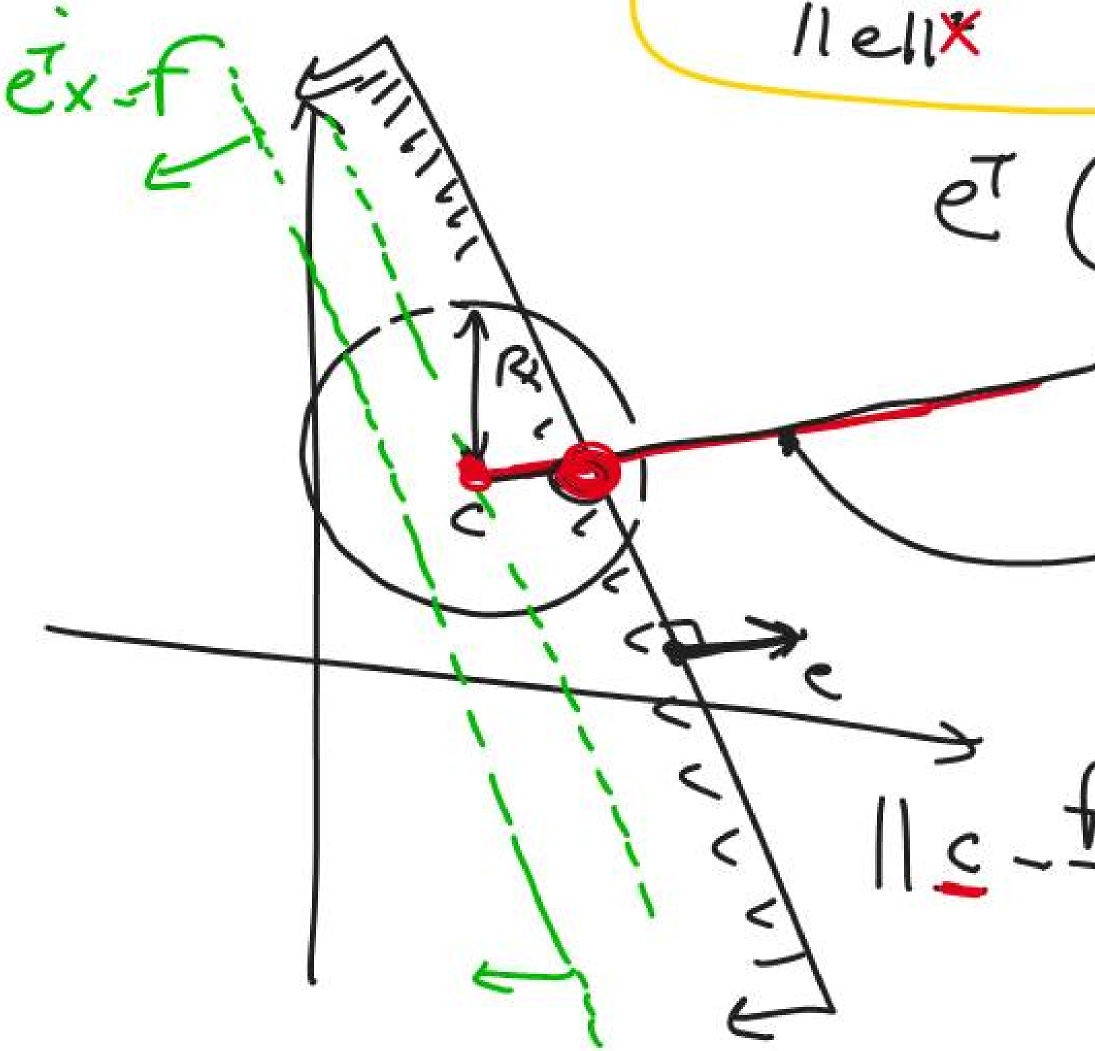
$$B(c,R) \subset H^{-}_{e_2,f_2} \qquad\qquad \vdots$$

$$\vdots \qquad\qquad g_k(c,R) \le 0$$

$$B(c,R) \subset H^{-}_{e_m,f_m}$$

$B(c,R) \subset H^-_{e,f} \Leftrightarrow ?$

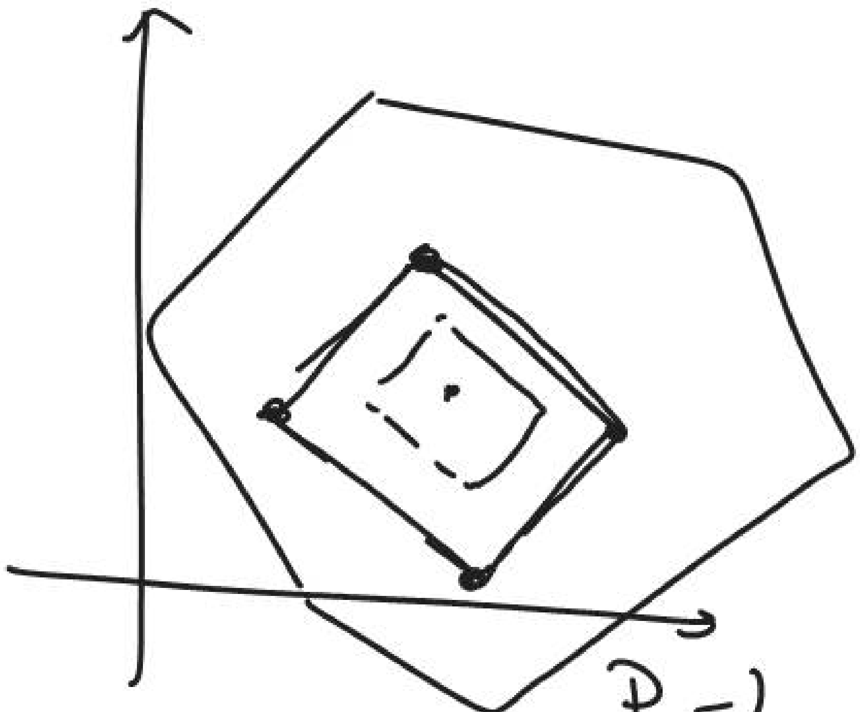
$$\frac{f - e^T c}{\|e\|^{\cancel{2}}} \geq R$$



$$e^T(c + t e) = f$$

$$t = \frac{f - e^T c}{\|e\|^2} \stackrel{?}{\geq} 0$$

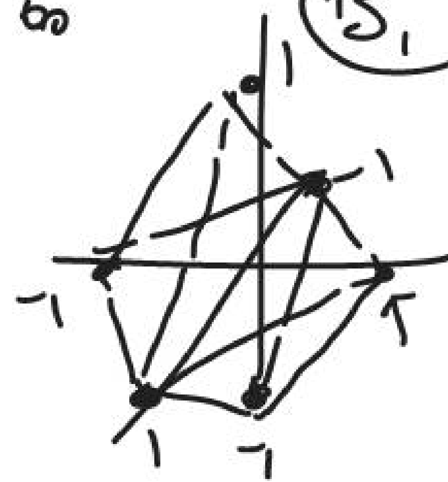
$$\left\| c - \frac{f - e^T c}{\|e\|^2} e \right\| \leq R$$



$$B_p(c,R) \subseteq H^-_{e,f}$$

$p = 1, \infty$

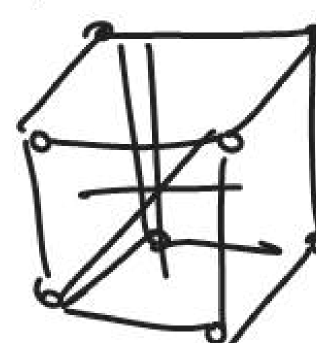
B_1 $2n$



$$P = \{x : Ex \le f\}$$

$$B_{1,\infty}(c,R) = \{x : \|x-c\|_{1,\infty} \le R\}$$

B_∞ 2^n



$$\min. \quad \|Hx - y_{des}\|_{op} \qquad 2 \quad 1 \qquad \text{var: } x$$

$$\text{s.t.} \quad Cx \le d$$

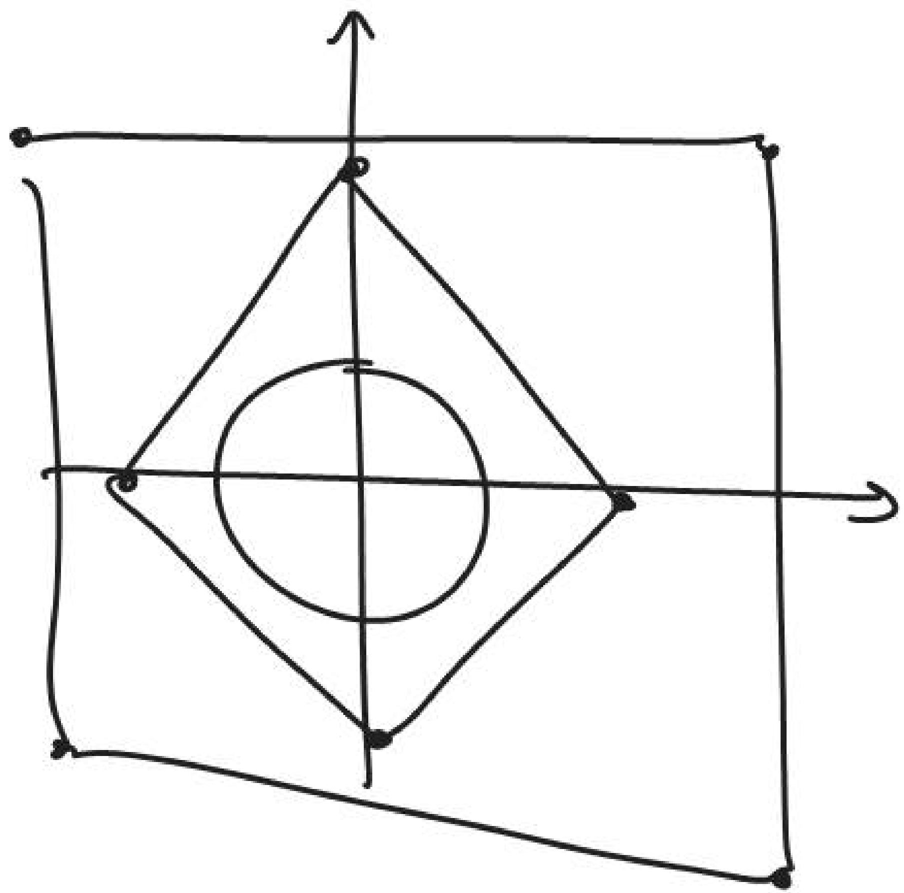
$$\Updownarrow$$

$$\min. \quad t$$

$$\text{s.t.} \quad \|Hx - y_{des}\|_{\infty} \le t \qquad \text{var: } (x, t)$$

$$Cx \le d$$

$$-t\mathbf{1} \le Hx - y_{des} \le t\mathbf{1}$$



$$\langle x, y \rangle \leq \|x\| \, \|y\|$$

$$\langle x, y \rangle \leq \|x\|_1 \, \|y\|_\infty$$

$$\uparrow$$

$$\left[\begin{array}{ll} \sup & x^T z \\ \text{s.t.} & \|z\|_\infty \leq 1 \end{array}\right] = \|x\|_1$$

$$\|a\|_\infty \le t$$

$$\Updownarrow$$

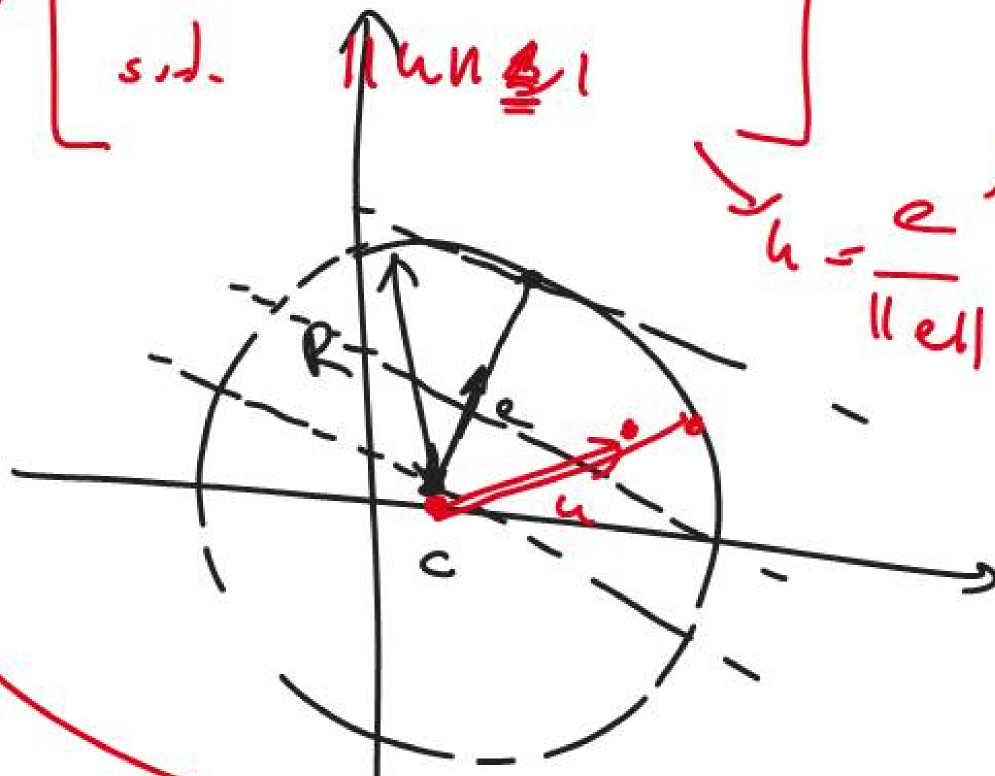
$$\max\{|a_1|,|a_2|,\dots,|a_m|\} \le t$$

$$\Updownarrow$$

$$\begin{matrix} |a_1| \le t \\ \vdots \\ |a_m| \le t \end{matrix} \quad \Leftrightarrow \quad \begin{matrix} -t \le a_1 \le t \\ \vdots \\ -t \le a_m \le t \end{matrix} \quad \Leftrightarrow \quad -t\mathbf{1} \le a \le t\mathbf{1}$$

$$\begin{bmatrix} \sup & e^T(c+Ru) \\ \text{s.t.} & \|u\| \le 1 \end{bmatrix} = e^T c + R\|e\|$$

$$u = \frac{e}{\|e\|}$$



$$A \subset H^-_{e,f}$$

$$=$$

$$\{x : e^T x \le f\}$$

$$\Updownarrow$$

$$\begin{bmatrix} \sup & e^T x \\ \text{s.t.} & x \in A \end{bmatrix} \le f$$

$$\Leftarrow$$

$$e^T c + R\|e\| = \begin{bmatrix} \sup & e^T x \\ \text{s.t.} & x \in B(c,R) \end{bmatrix} \le f$$