

## A. Original Set Covering Machine (SCM)

input:  $\mathcal{P}, \mathcal{N}, \rho, K$

initialization:  $f \leftarrow \emptyset$

repeat:

$$\hat{h} = \arg \max_{\substack{1 \leq i \leq n \\ h_i \notin f}} |\mathcal{P}(h_i)| - \rho \cdot |\mathcal{N}(h_i)|$$

$$\mathcal{P} \leftarrow \mathcal{P} \setminus \mathcal{P}(\hat{h}), \mathcal{N} \leftarrow \mathcal{N} \setminus \mathcal{N}(\hat{h})$$

$$f \leftarrow f \cup \hat{h}$$

until  $\mathcal{P} = \emptyset$  or  $|f| \geq K$

return  $f$

## B. Modified SCM with feature generation

input:  $\mathcal{P}, \mathcal{U}, \mathcal{N}, \rho_1, \rho_2, K$

$$f_{init}(\emptyset) \quad \begin{matrix} \text{initial rule set } (\emptyset \text{ by default),} \\ \text{used in bootstrapping} \end{matrix}$$

initialization:  $f \leftarrow f_{init}, \mathcal{U}_+ \leftarrow \emptyset$

$$\mathcal{H} \leftarrow \{h : h(x) \wedge h(x'), \exists x, x' \in \mathcal{P}, x \neq x'\}$$

$$\mathcal{P}' \leftarrow \mathcal{P}, \mathcal{U}' \leftarrow \mathcal{U}, \mathcal{N}' \leftarrow \mathcal{N}$$

repeat:

$$\begin{aligned} \hat{h} &= \arg \max_{h \in \mathcal{H} \setminus f} |\mathcal{P}'(h)| \\ &\quad - \rho_1 \cdot |\mathcal{U}'(h)| - \rho_2 \cdot |\mathcal{N}'(h)| \\ \text{for each } x_+ &\in \mathcal{P}'(\hat{h}), x \in \mathcal{U}'(\hat{h}) \\ \mathcal{H} &\leftarrow \mathcal{H} \cup \{h : h(x_+) \wedge h(x)\} \end{aligned}$$

end for

$$\mathcal{U}_+ \leftarrow \mathcal{U}'(\hat{h})$$

$$\mathcal{P}' \leftarrow \mathcal{P}' \setminus \mathcal{P}'(\hat{h})$$

$$\mathcal{U}' \leftarrow \mathcal{U}' \setminus \mathcal{U}'(\hat{h})$$

$$\mathcal{N}' \leftarrow \mathcal{N}' \setminus \mathcal{N}'(\hat{h})$$

$$f \leftarrow f \cup \hat{h}$$

until  $\mathcal{P} = \emptyset$  or  $|f| \geq K$

return  $f, \mathcal{U}_+$

## C. Semi-supervised SCM

input:  $\mathcal{P}, \mathcal{U}, \mathcal{N}, \rho_1, \rho_2, K, M$

initialization:  $f \leftarrow \emptyset, \mathcal{P}_u \leftarrow \emptyset, t = 1$

for  $i = 1$  to  $M$

$$[f, \mathcal{U}_+] \leftarrow \text{mSCM}(\mathcal{P} \cup \mathcal{P}_u, \mathcal{U}, \mathcal{N}, \rho_1 t, \rho_2, K, f)$$

$$\mathcal{P}_u \leftarrow \mathcal{P}_u \cup \mathcal{U}_+, \mathcal{U} \leftarrow \mathcal{U} \setminus \mathcal{U}_+$$

$$t \leftarrow t + |\mathcal{U}_+|$$

end for

return  $f, \mathcal{P}_u$