Set-theoretic interpretation

- Set of object pixels

$$F \equiv \{(x,y) : f(x,y) = 1\}$$

Continuous (x,y). *Works for discrete* [x,y] *in the same way.*

- Background: complement of foreground set

$$F^c \equiv \{(x,y) : f(x,y) = 0\}$$

- Dilation is Minkowski set addition

Commutative and associative!

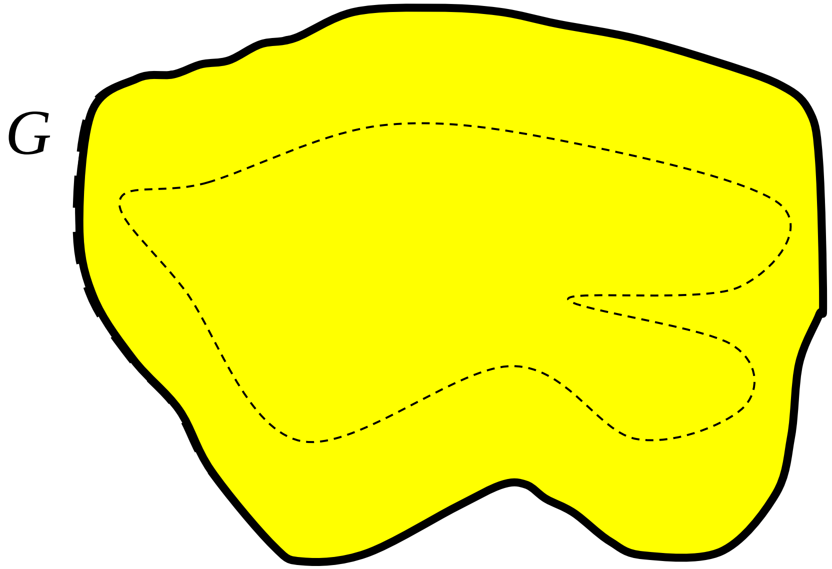
$$G = F \oplus \Pi_{xy}$$

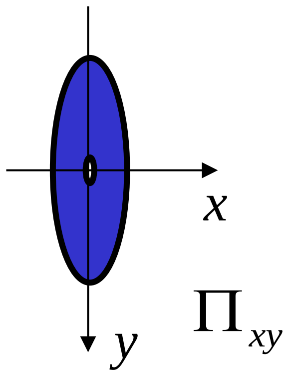
$$= \{(x + p_x, y + p_y) : (x,y) \in F, (p_x, p_y) \in \Pi_{xy}\}$$

$$= \bigcup_{(p_x, p_y) \in \Pi_{xy}} F_{+(p_x, p_y)}$$

translation of F by vector (p_x, p_y)

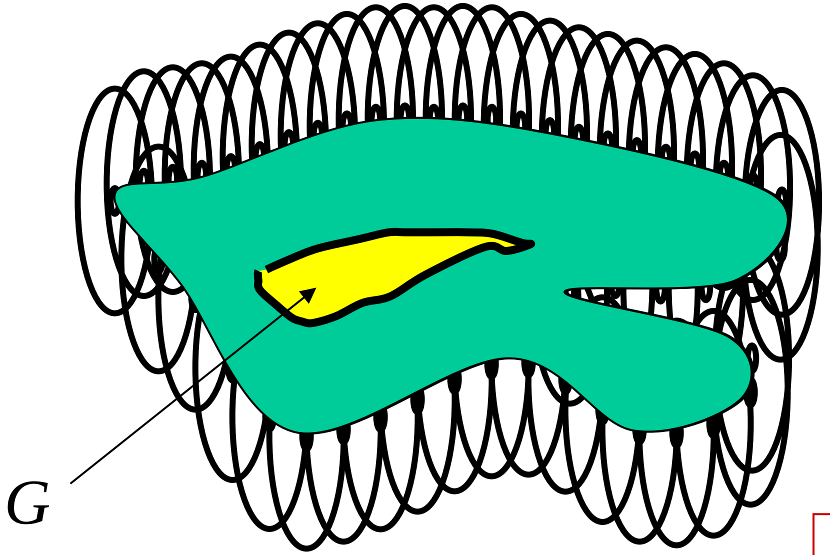
Set-theoretic interpretation: dilation

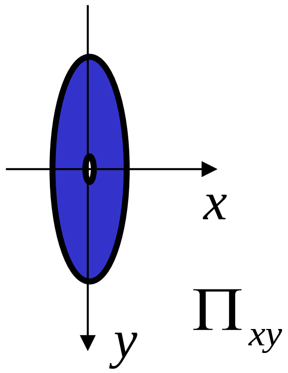




$$G = F \oplus \Pi_{xy}$$
$$= \left\{ \left(x + p_x, y + p_y \right) : \left(x, y \right) \in F, \left(p_x, p_y \right) \in \Pi_{xy} \right\}$$
$$= \bigcup_{\left(p_x, p_y \right) \in \Pi_{xy}} F_{+\left(p_x, p_y \right)}$$

Set-theoretic interpretation: erosion





Not commutative!
Not associative!

Minkowski set subtraction

$$G = \bigcap_{(p_x, p_y) \in \Pi_{xy}} F_{+(p_x, p_y)} = F \ominus \Pi_{-xy}$$

Reversed structuring element