Algorithm 1 Kernel Conditional Independence Test

X
Y
$width$ ▷ Optional: Kernel width for X and Y
$T \leftarrow length(Y)$
$X \leftarrow \frac{X-\bar{X}}{\sigma_X}$
$Y \leftarrow \frac{Y-\bar{Y}}{\sigma_Y}$

$\theta \leftarrow \frac{1}{width^2}$
$H \leftarrow eye(T) - \frac{ones(T,T)}{T}$ ▷ For centering data in feature space
$K_X \leftarrow H * kernel([X],[X],[\theta,1]) * H$
$K_Y \leftarrow H * kernel([Y],[Y],[\theta,1]) * H$
$Stat \leftarrow Tr(K_X * K_Y)$

$Mean_{appr} \leftarrow \frac{Tr(K_X)*Tr(K_Y)}{T}$
$Var_{appr} \leftarrow \frac{2*Tr(K_X*K_X)*Tr(K_Y*K_Y)}{T^2}$
$K_{appr} \leftarrow \frac{Mean^2_{appr}}{Var_{appr}}$
$\theta_{appr} \leftarrow \frac{Var_{appr}}{Mean_{appr}}$
$Pvalue \leftarrow 1 - \Gamma(Stat, K_{appr}, \theta_{appr})$

return $Pvalue, Stat$