Algorithm 1: tGMM

Input:

$x \in R^{T\times d}$: the time-series data.

$\mu^0 \in R^{d\times c}$: an initial guess at the means.

$\Sigma^0 \in R^{d\times d\times C}$: an initial guess at the covariances.

$\pi \in R^{T\times C} : \sum_{c\in[C]} \pi[., c] = 1$: some pi-vector indicating the contributions of each condition.

$tol > 0$: the tolerance for defining convergence.

Result:

$\mu^n \in R^{d\times c}$: the tGMM estimated means.

$\Sigma^n \in R^{d\times d\times c}$: the tGMM estimated true covariance matrices.

$ll = loglikelihood(x, \mu^0, \Sigma^0)$

converged = FALSE

while *converged = FALSE* **do**

    `// E step`

    for *t in 1:T* **do**

        $s = \sum_{c'=1}^{C} \pi_{tc} \mathcal{N}(x_t | \mu'_c, \Sigma'_c)$

        for *c in 1:C* **do**

            $\tilde{w}_{tc} = \frac{1}{s} \pi_{tc} \mathcal{N}(x_t, \mu_c \Sigma_c)$

        end

    end

    $\bar{\tilde{w}} = \sum_{c=1}^{C} \tilde{w}(., c)$

    $w_{tc} = \bar{\tilde{w}}^{-1} \tilde{w}_{tc}$

    $\hat{\tilde{w}} = \sum_{t=1}^{T} \tilde{w}(t, .)$ `// added this line`

    `// M step`

    for *c in 1:C* **do**

        $\mu_c = \hat{\tilde{w}}^{-1} w_c^T x$

        $\Sigma_c = \sum_{t=1}^{T} \hat{\tilde{w}}^{-1} w_{tc} (x_t - \mu_c)^T (x_t - \mu_c)$

    end

    $newll = loglikelihood(x, \mu, \Sigma)$

    if $newll - ll > tol$ **then**

        $ll = newll$

    else

        converged = TRUE

    end

end

$loglikelihood(x, \theta^i) \leftarrow \left(\sum_{i=1}^{nt} \log \left[\sum_{c=1}^{nc} \pi_{ic} \mathcal{N}(x_i | \mu_c^i, \Sigma_c^i) \right] \right)$

generate data: C=2 d=1 T=100 sigma=1 mu=-3, 3 pi(all els) = [1,0] for the first half, [0,1] for the second half

initialize:

pi=pi mu=mu sigma=sigma

initialize some wrong way