Algorithm 1 (Hartigan):

Input
  initial number of cluster $k > 0$
  dataset Y (N - dimension of data)
initial conditions
  obtain
  first random clustering $(\mathrm{Y}_1, \ldots, \mathrm{Y}_k)$
for $i = 1, \ldots, k$ **do**
    new propability $p_i = \frac{\mathrm{Card}(\mathrm{Y}_i)}{\mathrm{Card}(\mathrm{Y})}$
    new centers $\mathrm{m}_i = \mathrm{m}_{\mathrm{Y}_i} = \mathrm{m}_{\mathrm{Y}_i} = \sum_{y \in \mathrm{Y}_i} \frac{y}{\mathrm{Card}(\mathrm{Y}_i)}$
    new covariance matrix $\Sigma_i = \Sigma_{\mathrm{Y}_i} = \frac{1}{\mathrm{Card}(\mathrm{Y}_i)-1} \sum_{y \in \mathrm{Y}_i} (y - \mathrm{m}_{\mathrm{Y}_i})(y - \mathrm{m}_{\mathrm{Y}_i})^T$
    obtain the value of energy $E_i = p_i(-\ln(p_i) + H^\times(Y_i \| \mathcal{G}))) = p_i(-\ln(p_i) + \frac{1}{2}\ln\det\Sigma_i + \frac{N}{2}\ln(2\pi e))$
end for
repeat
  for $j = 1, \ldots, k$ **do**
    for $y \in \mathrm{Y}_j$ **do**
      for $i = 1, \ldots, k$ **do**
        if $E_i + E_j > p_i(-\ln(p_i) + H^\times(Y_j \cup \{y\}\|\mathcal{G}))) + p_i(-\ln(p_i) + H^\times(Y_i \setminus \{y\}\|\mathcal{G})))$ **then**
            ten warunek mona zapisac na wiele sposobow, nie twierdze, ze ten jest najleprzy
            switch y to Y_i (change value of m_i, Σ_i, p_i)
          if $\mathrm{Card}(\mathrm{Y}_i) < 1\% \cdot \mathrm{Card}(\mathrm{Y})$ **then**
              delete cluster Y_i (zmniejszam ilosc klastrow a punkty z usowanej grupy losowo przy-
              dzielam do innych, zmieniajac odpowiednie parametry.)
          end if
        end if
      end for
    end for
  end for
until no switch

$$
\begin{aligned}
l_{+y} &= l + 1, \\
\mathrm{m}_{+y} &= \frac{l\mathrm{m}+y}{l+1}, \\
\Sigma_{+y} &= \frac{l}{l+1}[\Sigma + \frac{1}{l+1}(\mathrm{m} - y)(\mathrm{m} - y)^T]. \\
l_{-y} &= l - 1, \\
\mathrm{m}_{-y} &= \frac{l}{l-1}\mathrm{m} - \frac{1}{l-1}y, \\
\Sigma_{-y} &= \frac{l}{l-1}[\Sigma - \frac{1}{l-1}(\mathrm{m} - y)(\mathrm{m} - y)^T], .
\end{aligned}
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