A note on the multiple fractional integrals defined on the product of quasi-metric measure spaces

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A complete characterization of a vector-measure \( \mu = (\mu_1, \ldots, \mu_n) \) governing the boundedness of the multiple fractional integral operator

\[
I_{\gamma} f(x_1, \ldots, x_n) = \int_{X_1} \cdots \int_{X_n} \frac{f(y_1, \ldots, y_n) d\mu_1(y_1) \cdots d\mu_n(y_n)}{\prod_{j=1}^{n} (d_j(x_j, y_j))^{1-\gamma_j}}, \quad \gamma = (\gamma_1, \ldots, \gamma_n)
\]

from one mixed norm Lebesgue space \( L^{p_1}_{\mu_1} \) to another one \( L^{q_1}_{\mu_1} \) is obtained, where \((X_i, d_i, \mu_i), \ i = 1, \ldots, n,\) are quasi-metric measure spaces (spaces of nonhomogeneous type).

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