From Probability to Correlation

$$q_-^k(\alpha,\rho) = \int_{-\infty}^{\infty}\int_{-\infty}^{\delta_k}\int_{-\infty}^{\delta_k} \mathcal{N}\left(\begin{bmatrix} u_i \\ u_j \end{bmatrix} \middle| \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right) p(\delta_k|\alpha)\, du_i\, du_j\, d\delta_k$$

$$q_+^k(\alpha,\rho) = \int_{-\infty}^{\infty}\int_{\delta_k}^{\infty}\int_{\delta_k}^{\infty} \mathcal{N}\left(\begin{bmatrix} u_i \\ u_j \end{bmatrix} \middle| \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}\right) p(\delta_k|\alpha)\, du_i\, du_j\, d\delta_k$$

$$p_{ij} = q_-^1(\alpha,\rho) + q_-^2(\alpha,\rho)q_+^1(\alpha,\rho) + q_-^3(\alpha,\rho)q_+^1(\alpha,\rho)q_+^2(\alpha,\rho) + \ldots$$

There is an injective mapping between covariance and the probability that two superpixels are in the same segment.