Assuming a multivariate normal distribution for the underlying factors, f, the likelihood function is

$$\mathcal{L} = \frac{1}{(2\pi)^{n/2} |\Sigma|^{1/2}} e^{-(f-\mu)^T \Sigma^{-1} (f-\mu)/2}$$

where n : number of factors

Σ : covariance matrix of factors

μ : mean of factors

If we maximize log-likelihood, with respect to f, it is equivalent to maximizing

$$-\frac{1}{2} (f-\mu)^T \Sigma^{-1} (f-\mu)$$

as the rest does not depend on f

We also have the constraint $Af = v$, which defines the set of views specified by the user.

To solve this optimization problem, we write the Lagrangian function such as

$$\mathcal{L}(f, d) = -\frac{1}{2} (f-\mu)^T \Sigma^{-1} (f-\mu) - d^T (Af - v)$$

maximize wrt f and d $\Rightarrow$

① $-(\Sigma^{-1} f - \Sigma^{-1} \mu) - A^T d = 0$

② $Af = v$

$\Rightarrow$ Multiplying ① by $A\Sigma$ from left and rearranging, we get

③ $Af + (A \Sigma A^T) d = A\mu$

$\Rightarrow d = (A \Sigma A^T)^{-1} (A\mu - v)$ by replacing Af with v

Then replacing d in ① with this equation we write

$$-(\Sigma^{-1} f - \Sigma^{-1} \mu) - A^T (A \Sigma A^T)^{-1} (A\mu - v) = 0$$

$$\Rightarrow f = \mu - \Sigma A^T (A \Sigma A^T)^{-1} (A\mu - v)$$