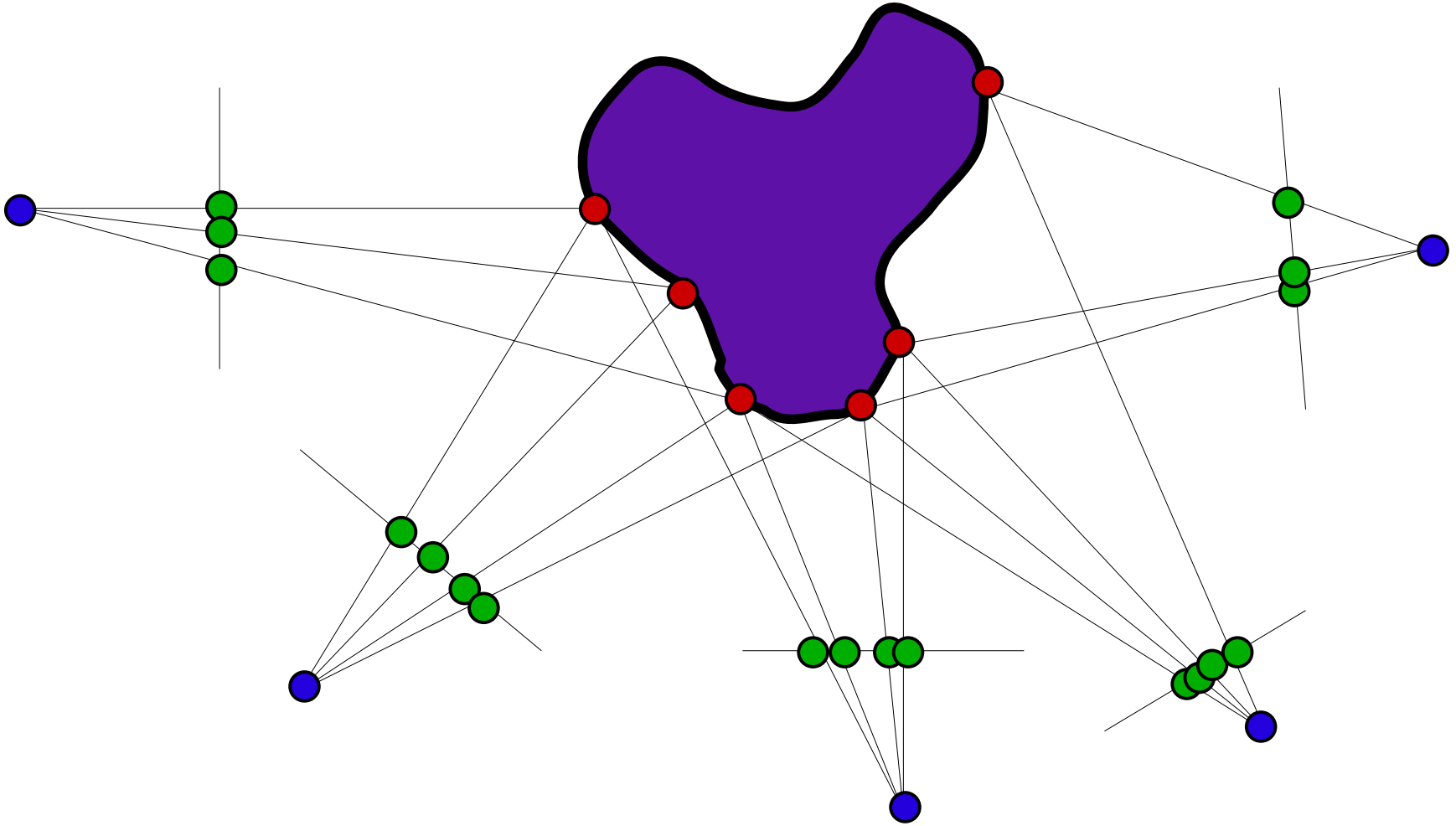
N-view reconstruction

Have: Image points: $\overset{i}{x}_{j}$ Want: Scene points: Xi Cameras: Pj



Issues compared to 2-view

No simple relation between views as n grows

All scene points not visible in all cameras

Closed form solutions requires extra constraints

General Method

Find an initial solution

Refine with *bundle adjustment*

Initial solutions
correspondences given

If all points are visible in all views, it is possible to get a solution through factorization – if additional constraints are imposed (Magnus)

Use points known to be on a scene plane

If images are from a sequence (small baseline), sub-sequences can be used in different ways

Use black magic

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Reconstruction via reference plane

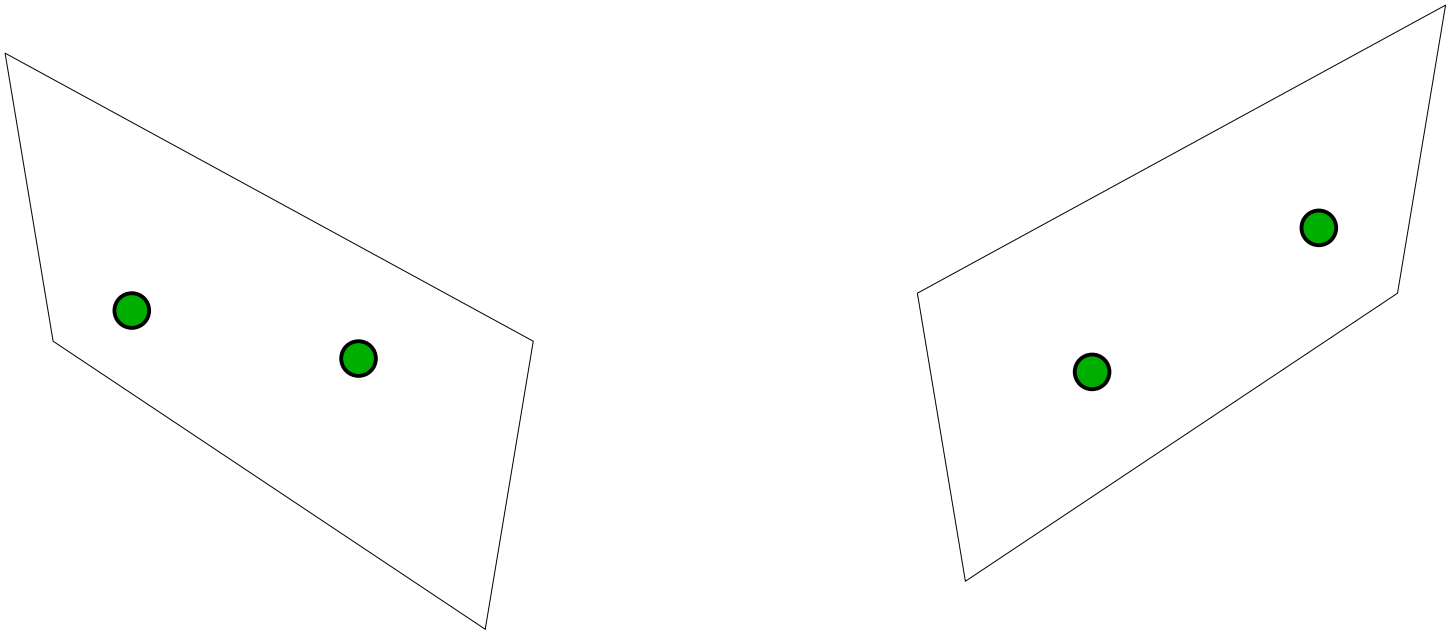
Assume a subset of the scene points reside on a plane

Compute homographies between cameras from these points

Solve for structure and motion from the rest of the points

Bundle Adjustment

$$\min_{\hat{X}_i, \hat{P}_j} \sum_{i,j} d(\hat{P}_j \hat{X}_i, x_j^i)^2$$



How to solve?

Non-linear equation system

Given N points and M cameras - 3N+11M parameters to optimize

Levenberg-Marquardt (LM) algorithm commonly used – cannot be used as is when N and M grow

- Fix cameras or points, solve for each iteratively
- Use sparse techniques