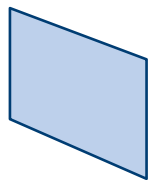# 3D Data Processing
Lab 2: Structure from Motion (notes)

Alberto Pretto

Scene Graph
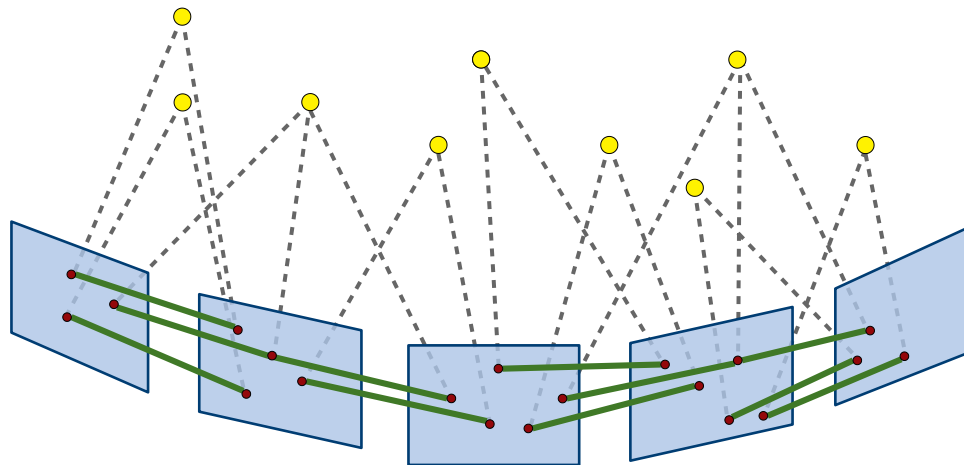
int num_cam_poses_ = 5;
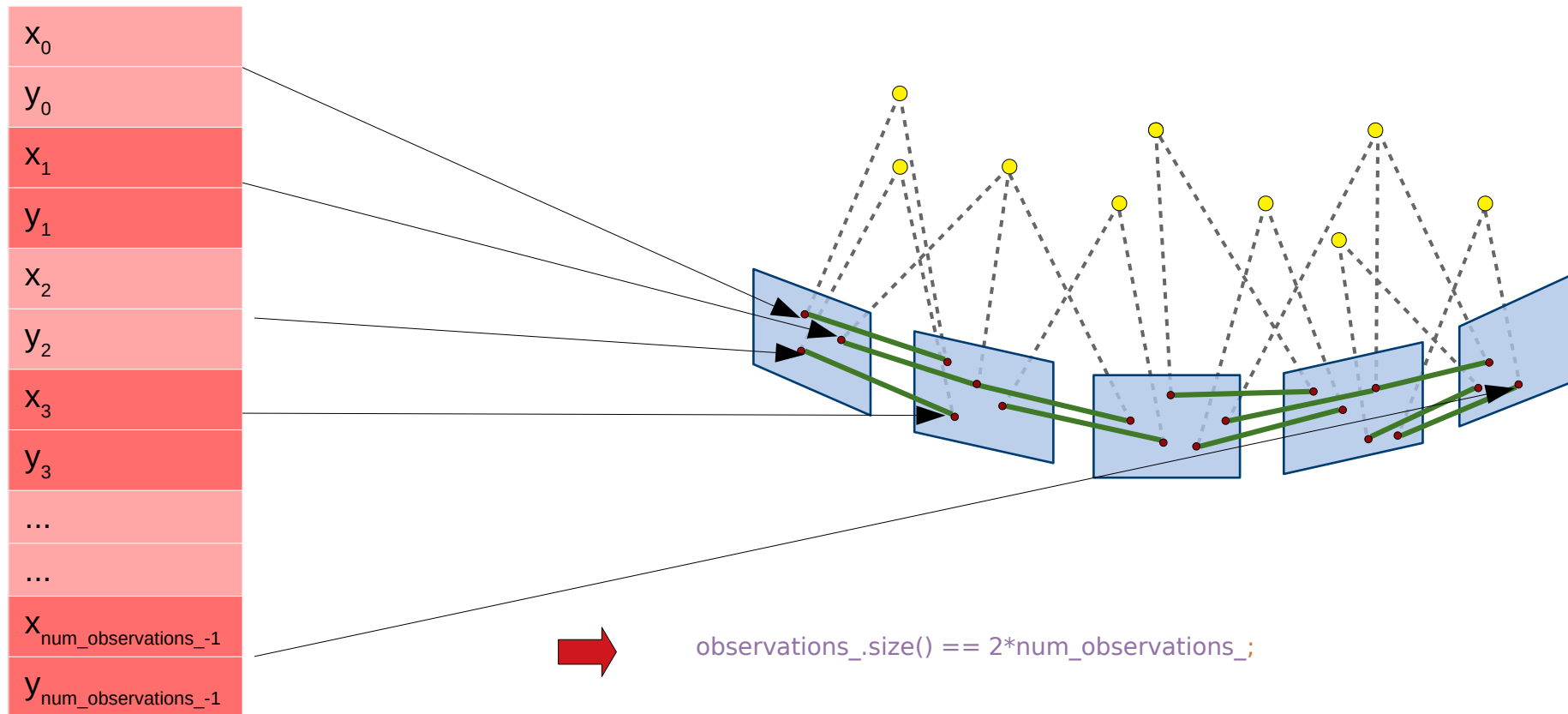
int num_points_ = 9;

int num_observations_ = 20;

// 6 * num_cam_poses_ + 3 * num_points_
int num_parameters_ = 90;

Observations

std::vector<double> observations_; // Vector of observations, i.e. 2D point projections in all images of the observed 3D points.

x_0

y_0

x_1

y_1

x_2

y_2

x_3

y_3

...

...

$x_{num\_observations\_-1}$

$y_{num\_observations\_-1}$

observations_.size() == 2*num_observations_;

Camera positions

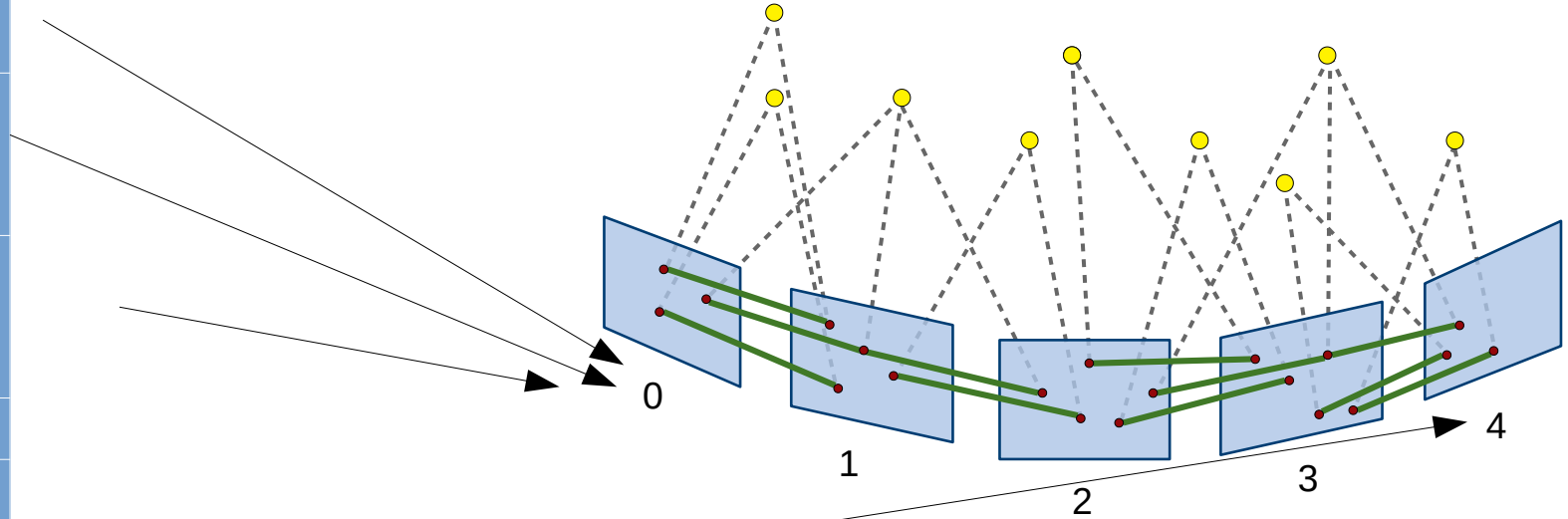
std::vector<int> cam_pose_index_;

Index of the camera that made observation 0

Index of the camera that made observation 1

Index of the camera that made observation 2

...

Index of the camera that made observation num_observations_ -1

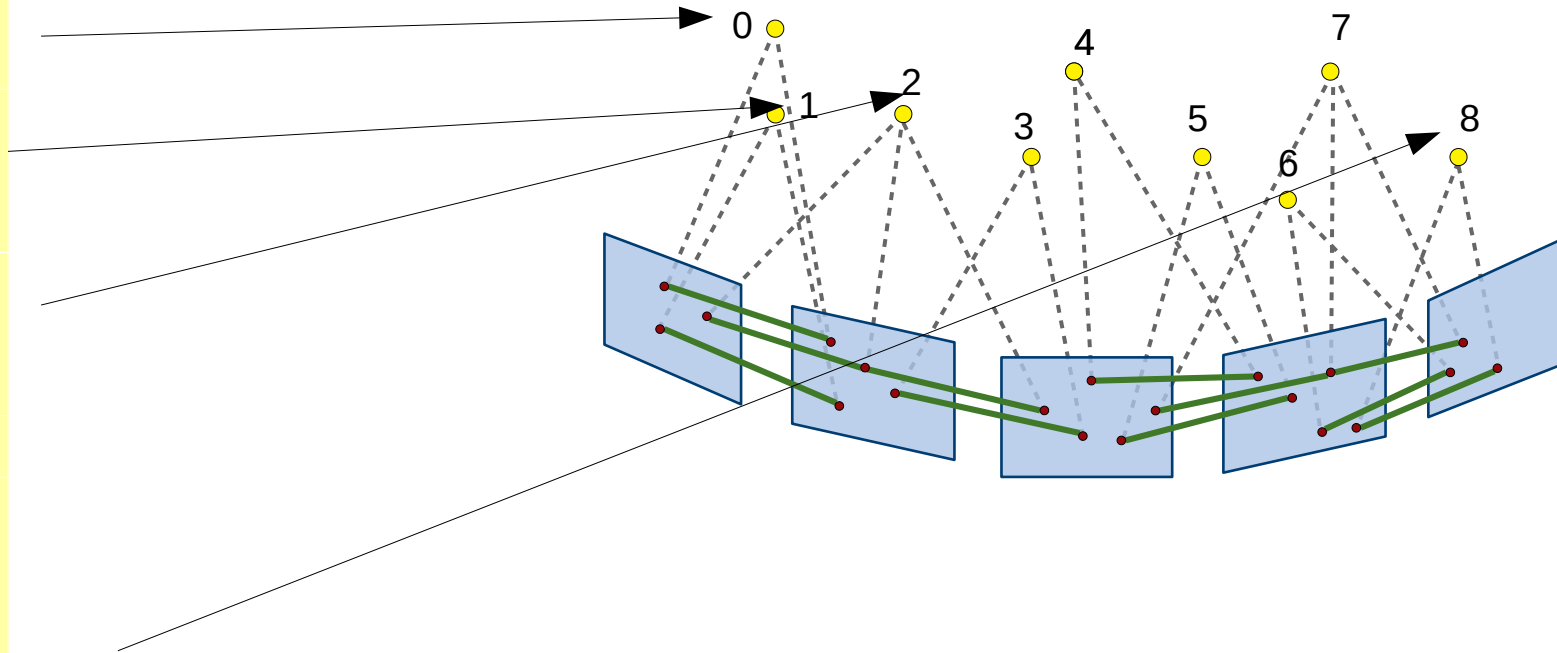0

1

2

3

4

3D Points

Index of the 3D point that generates sobservation 0

Index of the 3D point that generates sobservation 1

Index of the 3D point that generates sobservation 2

...

Index of the 3D point that generates sobservation num_observations_-1

Parameters

```
// Vector of all the parameters to be estimated: it is composed by num_cam_poses_ 6D blocks
// (3D axis-angle rotation and 3D translation, one for each camera view) followed by num_points_
// 3D blocks (one for each 3D point). Assume:
// n = num_cam_poses_
// m = num_points_
std::vector<double> parameters_;
```

$r_x cam_0$	$r_y cam_0$	$r_z cam_0$	$t_x cam_0$	$t_y cam_0$	$t_z cam_0$	$r_x cam_1$	$r_y cam_1$	$r_z cam_1$	$t_x cam_1$	$t_y cam_1$	$t_z cam_1$	...

...	$r_x cam_{n-1}$	$r_y cam_{n-1}$	$r_z cam_{n-1}$	$t_x cam_{n-1}$	$t_y cam_{n-1}$	$t_z cam_{n-1}$	...	x_p_0	y_p_0	z_p_0	...	...

...	...	...	...	...	...	...	...	...	...	x_p_{m-1}	y_p_{m-1}	z_p_{m-1}