1.背景：视频分析的准确率和资源需求随配置不同而不同；最佳配置选择在视频的不同时刻也有变化。大多数现存的视频分析系统都假定视频具有静止的环境，故只在视频开头分析一次并选择配置，而忽视了配置最优解的可变性，造成资源浪费或准确率不达标。故作者提出变色龙——可以周期性地检查并改变配置，使其适合于当前时刻的视频内容，进而提高准确率，降低资源耗费。

2.问题：周期性改变配置需要指数级的搜索空间（随配置各knob的值和预测模型的不同选择而产生），造成很大的资源消耗，以至于抵消了产生的资源收益。

naive continuous profiling is expensive for three reasons. We have to frequently run the golden configuration on each video stream, we have to profile all video streams, and the configuration space is exponentially large.

3.解决：利用配置的**时间和空间相关性**以及**经验结论：knob独立影响精度。**

Chameleon tackles these challenges using three domainspecific empirical observations about the impact of configurations on the accuracy and cost of video analytics pipelines. First, if the NN configurations’ resource-accuracy tradeoff is affected by some persistent characteristics of the video, we can learn these temporal correlations to reuse configurations over time (§4.1). Second, if two video feeds share similar characteristics, it is likely they will also share the same best configurations. Such cross-camera correlations provide an opportunity to amortize profiling cost across multiple camera feeds (§4.2). Finally, we have experimentally observed that many of the configuration knobs independently impact accuracy, allowing us to avoid an exponential search.

解决问题①：根据时间相关性重用配置，减少运行黄金配置的必要性（即次数）？此外还可以由选择top-k来减少搜素空间；

解决问题②：根据空间相关性，相似视频源可以共用相同的配置，故对一组相似的视频源，只需对其中一个作分析（profiling）即可；

解决问题③：根据观察得到的经验结论，各knob独立地对准确率产生影响，可以极大减小指数级搜索空间而化为**线性级**。这里依然使用了贪心算法。此外，还可以通过结合各个knob对准确率独立的影响来分析其总准确率，进而避免使用黄金配置来估计准确率？。

4.结果： 提出变色龙。we leverage these observations to develop Chameleon, a video analytics system that optimizes resource consumption and inference accuracy of video analytics pipelines, by adapting their configurations in real-time.

5.时间相关性（Time correlation）：**Persistent characteristics over time**: While the characteristics of videos change over time, the underlying characteristics of the video objects (e.g., size, class, viewing angle) that affect accuracy tend to remain relatively stable over time. Similarly, good configurations also tend to consistently produce good performance. More generally, even though the best configuration, i.e., the one with the lowest cost meeting the accuracy threshold α, might change frequently, the set of top-k best configurations (top-k cheapest configurations with accuracy ≥ α) tend to remain stable over time. Thus, we can dramatically reduce the search space by focusing on these top-k configurations.

6.空间相关性（Space correlation）：**Cross-camera similarities**：similar videos tend to have similar distributions of best configurations. Then, we can use the most promising configurations from one camera—e.g., the top-k best configurations—to guide the profiling of a spatially-related camera. Finally, we do not simply apply the same configurations on all cameras.地理位置相近或使用目的相同的摄像头间具有相似的特点。进而，往往会享有相同的最佳配置。

7. Independence of configuration knobs.

This has two important implications. First, it lets us tune the resolution knob independent of the frame rate; this prunes a large part of the configuration space. Second, it lets us estimate a configuration’s accuracy by combining its per-knob accuracies; in particular, we can do this without running the expensive golden configuration.Furthermore, In our setting, the configuration knobs have monotonic impact on cost, i.e., increasing the value of a knob while holding the other knobs fixed increases the resource demand of the configuration.

8.空间相关性中对一组相似摄像头再分组：简单地利用准确率：

We use the following simple grouping algorithm. The algorithm starts with a randomly chosen configuration and profiles all videos on it, then uses the accuracy results to create an initial grouping using a simplified version of kmeans—essentially, sort the accuracy values and bound the deviation from the minimum of a group. We repeat this process by using another randomly chosen configuration to subdivide the groups created by the previous round, and so on. This greedy refinement stops when enough configurations have been tested or the groups become too small.