Online advertising can target users at a fine level of granularity. To do this effectively, we need models to represent users and their behavior. In this thesis, we study several problems related to models of online users.

- We implement a user-profile driven ad crawler system and empirically investigate the relationship between user profiles and ads shown to them. We observe user profiles play a greater role in display ads than in video ads.

- We design a neural network model app2vec to vectorize mobile apps, by looking at how users use these apps. We analyze the learned app vectors qualitatively and quantitatively and use these vectors to design efficient algorithms for app-install advertising, such as ad conversion prediction and ad selection.

- Finally, we design a lookalike audience extension system. Advertisers provide a list of past converters as "seed users", and our system determines users similar to the seed. Rather than assuming linear separability of lookalike and non-lookalike users like in prior work, we propose a campaign specific nearest-neighbor based approach. Our system works efficiently on billions of users and effectively improves ad campaign conversion rate in practice at Yahoo!.